THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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READY!

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1907 EDITION.

H. ALABASTER, GATEHOUSE & CO.,

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EMERGENCY BRAKES.

WE are glad to have the opportunity of recording, so soon after the Carshalton and other accidents, certain tests which have been made on a car equipped with a new form of brake, for the results give great reason to hope that our own views on this grave question may be within measurable distance of realisation.

Our representative was present at some of the tests, and has been afforded by the inventor, who is a gentleman well known in electrical and tramway circles, the fullest opportunities for examining every particular of the mechanism, which is, indeed, of the simplest description. As the time is not yet ripe for divulging the nature of the apparatus, or the novel principle which is involved, we are not at liberty to do more at the moment than to indicate in a general manner the action and effect of the brake.

During recent years we have felt more and more strongly that tramcar braking will settle down ultimately on lines which diverge widely from those which were familiar when horses and steam engines ruled the roost. On the other hand, there is the party of conservative principles, trained among those very forms of motive power, which will hear of nothing but the wheel brake, with the rheostatic and short-circuiting brakes as standbys; and there is again the more advanced and more numerous party which holds with an equipment comprising the old wheel brake, and some kind of track brake. This party is split into sections which believe in one or other form of track brake, and we look forward to the time when these differences will be sunk in favour of the magnetic principle.

All these parties and sects are opposed in a greater or lesser degree to our advanced view, but every car which runs away brings nearer the day on which that view will find general acceptance.

First of all, the wheel brake will be sent to the shades to join the horse cars from which it was riven; then the hand-power slipper brake will vanish, and finally the electric car will emerge in the simplicity of an electro-magnetic, or a mechanico-electro-magnetic, or a pneumatic track brake, for service use, and an emergency brake, of which it might be said that it cannot fail, if it were wise to make such an uncompromising assertion of anything on earth.

There will be a single service brake and a single emergency brake. The service brake will be one which is least likely to help a runaway on its course; that is to say, with it the driver, having over-run the safe speed, cannot skid the wheels; and the emergency device will be a brake which cannot be utilised conveniently as an alternative to the service brake, is constructed with the minimum of parts, each amply strong to withstand the most violent usage imaginable, and one which is brought into instant and full action from either end of the car by a single elementary motion which calls for no exercise of discrimination or judgment.

At a time when there was no sign of an emergency brake capable of fulfilling these requirements, we recommended that the service brake should be so independent, and possessed of such a reserve of power, as to be the emergency brake also. This advice was sound then, and remains so until the true emergency brake is brought forward, because it is most desirable that a driver shall not be confused at a crisis.

It may be said that the arrival of our ideal emergency brake would render unnecessary any particular consideration of the form of service brake which should be used, and up to a point that is true, but a little reflection will induce a different frame of mind, for apart from any question of safety the wheel brake is objectionable, and the hand-worked slipper brake is laborious to use.

What the ideal emergency brake will do is to reduce the number of service brakes to one, and that one of a simple but powerful variety : for present choice, the plain magnetic slipper with notches on the controller for "holding" the car from the trolley wire.

It would not become us, or be at all consonant with our traditions, did we venture to suggest that the invention which produced the results printed in another column is the emergency brake which is to fulfil our ideal requirements, but we do not hesitate to say that its appearance has given us new hope, and has done something to modify our ideas.

This brake is independent of current from the motors or the trolley wire ; the state of the rails seems not to affect its action ; and nothing that the driver may have done or left undone with any number of service brakes matters in the least. It is in duplicate, and in coming into action it is as instantaneous as a free mass dropping vertically can make it. There is no gradation, the maximum effect being produced immediately, yet the rate of retardation is not high enough to create discomfort, and that is a peculiarity which differentiates this emergency brake from any which we have seen. The aim of the inventor seems to have been to evolve a certain rather than a sudden brake, and so far as the tests have been carried he has succeeded. The speeds here recorded are little in excess of 16 M.P.H. on a grade of 1 in 12, but there is no reason to suppose that the brake will be less effective at higher speeds.

When permission is given we shall publish full particulars and further tests.

The Retirement of Mr. Gavey.

THERE can have been but few occasions so fraught with interest as those recorded elsewhere in our issue of to-day in connection with the retirement of Mr. Gavey from the position of Engineer-in-Chief of the Post Office. In the afternoon of Thursday last week he was the recipient of gifts from his colleagues to himself and members of his family, which were intended to convey in some lasting form a testimony of the appreciation of the staff for their retiring chief ; and in the evening of the same day he was the guest of honour at a banquet organised by the staff, and participated in by those who have had the good fortune to be associated with his work. Presided over by the political head of the Department, supported by the permanent head of the Department, attended by the head of the Institution associated with electrical science, and by most of those concerned in the practical work of telegraphy, telephony and other arts connected therewith, the function was one which was a source of gratification to all who participated in it. And who is the man whom all men thus delight to honour ? John Gavey was in the early sixties a pioneer in a then developing scientific-commercial enterprise, which was taken over by the State in 1870. Entering the service of the State, he attained the highest post available to the engineer, by reason of a steady persistent attention to his work, by high technical knowledge, and by the exercise of sound judgment on the many problems presenting themselves. And how comes it that no note is heard to mar the harmony of general applause ? No man can have gone through life and exercised the responsibilities of Mr. Gavey's position without incurring the risk of making enemies. The celebrated Spanish general had no enemies left, for an excellent reason in the case of an expert swordsman in warlike days. We believe Mr. Gavey has no enemies for the more excellent reason that all who may have seemed to have ground for complaint have realised that any action of his, whether apparently right or apparently wrong, has been governed by a high sense of duty. It is well for the State, it is well for the Service, that hard work and strong character should receive such recognition as we have to record.

Copper.

THE supplies and values of this indispensable metal constitute at the present time a subject of the greatest interest to the whole engineering profession, and especially so to the electrical section. The numerous complications introduced into modern trading, by the conventions by which a man is able to buy that which does not exist and sell it before it is delivered, make it as much a matter of mathematics as of actual handling of goods. Supposing trade were simply a matter of supply and demand, with the facilities of information which we possess, it would be comparatively easy to balance the quantity of the commodity available against the needs of manufacture, and to arrive at a close approximation to the price to be expected ; but in cases where it is possible, as it is in the largest copper-producing country, for one man to absorb an entire industry and use it as a plaything, the eccentricities of the market are quite beyond prediction. The recent nervousness and subsequent scare which produced so sudden a fall in price has been theorised over extensively. A writer in the *Times Financial Supplement* recently summarised the apparent causes of the present falling markets, as being shortness of money generally, causing lack of investment, aggravated by the compulsory selling out by speculators who can no longer carry their stock. In the case of copper there may also be intentional selling to further weaken shares required for a combine, though, for the investor's sake, it is to be hoped such operations are not included in the present situation. The same journal contains interesting items as to production and prices for the year, based on Messrs. H. R. Merton & Co.'s annual summary. The total production for 1906 was 711,675 tons. The article gives the yearly outputs since 1900, from which we find that, up to 1904, the increase per annum was some 30,000 tons : 1904 was 69,000 better than the previous year, and the additions for 1905 and 1906 were only 40,000 and 29,000 respectively. The writer considers this as pointing to the fact that the mines are being worked up to their full limit. This is a reasonable conclusion, but it is rather hard to account for the great increase of production in 1905, except on the supposition that stocks had been allowed to accumulate.

The United States has effected the largest increase in output of any country, and this points to the fact that improved methods of mining are of the greatest value to the industry. The resources of the States are undoubtedly large, but there must be great quantities of undeveloped ore in Spain, Mexico, Canada, Australia, Peru and Japan, which will ultimately succeed in influencing the market.

An interesting curve concludes the article, which gives the comparison between production and prices since 1896. The production is, on the whole, steady, being accelerated after

1903, but not in proportion to the rise. The effect of the rapid rise in price in 1899 from £52 to £74 was not felt by the production till 1901, or 1½ years later. The present rise to above that level commenced in 1905, and the production, though well on the increase, has not had time to catch it up.

Electrolysis by Alternating Currents.

Dr. C. P. Steinmetz has done much important research work in connection with electric traction, and the experiments which formed the material for a paper on the above subject, lately read before the American Institution of Electrical Engineers, are worthy of his reputation. The definite conclusions which are drawn from the results of these experiments must be hailed with feelings of relief by all those who are interested in the present and the future of alternating, and particularly of single-phase, current for traction, for they are entirely confirmatory of the early belief that alternating currents do not produce any serious damage to gas and water services.

The *Western Electrician* of March 9th condenses the main conclusions of the paper, and reports an interesting discussion. Very briefly, we may say that Steinmetz believes alternating electrolysis to be erratic in character, not subject to the rule of quantitative law like the direct-current phenomenon. It is able to occur at all only because the action of the positive wave is not quite reversed by the negative wave of each period, and Prof. A. F. Ganz helps us further by suggesting that the reason lies in the fact that part of the products of the positive or erosive wave are diffused before the negative or reconstructional wave can begin its work; and the discovery of Prof. Steinmetz—that the amount of electrolysis varies with the nature of the electrolyte and with the kind of metal attacked—is explained on the same lines by the variation in the rates of diffusion of the products of electrolytic action. It is because of this variability that lead is the most vulnerable to stray alternating current, while in the words of Prof. Steinmetz himself, "iron is a material which is attacked least; even wrought-iron is not attacked very badly, steel very much less, and those iron carbides and silicides called cast-iron are attacked hardly at all."

The diffusion theory accounts well, too, for the observed fact that the rate of action on any metal increases with a decreasing frequency.

In order to prevent direct-current tramways from causing damage by electrolysis, the Board of Trade put a limit to the current density in the return; but alternating-current electrolysis does not depend appreciably on current density, except that the action increases rapidly with temperature, so that densities so high as to cause considerable heating, and only such extreme and unpractical densities, can do harm.

Experiments have been made parallel with those of Dr. Steinmetz by other authorities, and Mr. S. M. Kintner took the precaution of burying duplicate lengths of pipe for every test, one being subjected to alternating-current action, and the other to nothing but the chemical action of the soil. He found no difference in appearance, and almost no difference in weight between the two sets, of whatever metal the pipes were made, and he holds the opinion that no damage of any consequence, even to lead pipes, can be caused by alternating-current electrolysis. Dr. Steinmetz, on the other hand, thinks that lead-sheathed cables may suffer seriously, even from alternating current.

Previous investigators have determined the rail drop on single-phase systems at a high figure in comparison with direct-current service of the same nature; but we know now that the reason for limiting the maximum drop with direct current is of no account when alternating current is in question, when the permissible drop becomes a matter almost entirely of efficiency, and may be left to the discretion of the owners of the tramway. This can be appreciated readily when the electrolytic action of alternating current is stated to be even less than half of 1 per cent. of the action which would be caused by direct current.

Bow v. Trolley.

A plea based on Continental favour is entered for the sliding bow in the *Street Railway Journal*. Its collecting capacity is inferior to that of the wheel, but this is easily remedied by doubling the wires at those parts of a line where heavy currents are taken. That is all very well when the double-wired sections are not so numerous as they would have to be on hilly lines, or where heavy cars with speedy motors are used; although expenditure on trolley wire, which hardly wears at all when properly suspended, is no waste if feeders are saved. Double trolley wires for each bow are used on parts of the Amsterdam-Haarlem Railway, which are a long way from the power house.

The life of a bow varies from 5,000 to 25,000 car-miles, while an English trolley wheel lasts from 3,000 to 6,000 car-miles. The general impression is that the maintenance of the bow is greater than that of the wheel, but we think that this need not be so in every case, and even if it were, there is said to be an improvement in the condition af the trolley wire, which must be put to the credit of the bow. It is obvious that at curves, if nowhere else, the bow has the advantage, because the construction can be simpler, and the wear no more than on the straight. The bow cannot be used with the pressures usual on trolley poles, and has to be lubricated plentifully, even though it rubs along the wire with as little as 8 lb. pressure. Nothing like high speeds can be attained unless this minimum pressure is greatly increased, or unless the collecting apparatus is made complicated. We are open to correction by the few people in this country who know much about the bow, when we suggest that the trolley wheel will give more satisfaction than the bow on the standard English double-decker, running at an average speed, including stops, of something between 7 and 10 M.P.H., and being capable of attaining a speed of 20 M.P.H. and over, so long as the trolley wire offers a smooth path to the wheel. There is little reason to suppose that the bow will be used in future to a much greater extent, either in America or over here, than it is now.

Wiring Rules of the I.E.E.

Last night the publication of the revised edition of the Wiring Rules was announced to the Institution, and they are now to be had from the publishers, or from the offices of the Institution. The revision has been carried out by a Committee, on which were represented the M.E.A., the E.C.A., the Institution, and two of the leading Fire Offices, and which received assistance from the Engineering Standards Committee and the Cable Makers' Association. The Rules will be periodically revised, and the Committee has been appointed a "Standing Committee," which will always be pleased to consider suggestions or criticisms. With the new issue are incorporated extracts from the B. of T. Regulations and the Home Office Rules for Mines.

A first glance through the new Rules gives one the impression that the old ones have been put in a bag and shaken up, for we find, for example, paragraphs 97-105 now numbered 3-11, and the order of other paragraphs has been radically changed: No. 94 has become No. 41, while No. 29 is now No. 42. Close examination shows that these and similar alterations have the effect of bringing together cognate matters which previously were widely separated, and, indeed, their appropriateness is generally so obvious that one almost wonders why the former arrangement was ever tolerated. An advantage which, whether premeditated or not, will certainly ensue from the re-arrangement is that those whose business it is to have these rules at their fingers' ends will be obliged to read practically every word in order to ascertain where and what changes have been made. Needless repetitions have been cut out, and the literary style of the work, which was not beyond criticism, has been improved. Especially important are the changes made with a view to gaining clearer definition. For instances, "insulating material" has been substituted for "insulation," where the thing is concerned, not the condition, and "covered" takes the place of "insulated" where it is necessary to distinguish between bare wires supported on insulators, and wires covered with insulating material. An extremely useful innovation consists in the insertion of cross-references to paragraphs of kindred nature, which greatly facilitate the use of the rules.

D

A NEW EMERGENCY BRAKE.

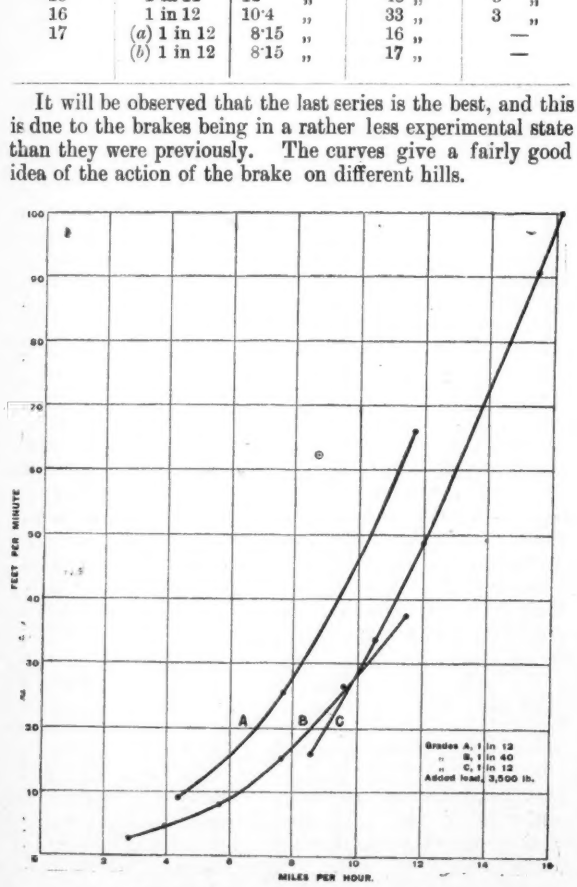
THE following are some results of tests made on a car fitted with a new form of brake, which is intended for use in emergencies only.

The speeds were observed on a calibrated tachometer, and the operation of the brake enabled the distances travelled after application to be measured accurately. At no time was the rate of retardation sufficient to hurt, or even to annoy, unprepared passengers,

The condition of the rail varied from greasy to dry, and from gritty to clean. The car was of the standard top-decked single-truck type, and was loaded with ballast, in addition to the four or five persons who conducted the tests.

Test No.	Approximate grade.	Speed when brake was applied.	Distance travelled after application of brake.	Time taken to stop.
Series I.				
1	(*a*) 1 in 40	14·7 M.P.H.	51 ft.	Not recorded
	(*b*) 1 in 40	14·15 ,,	47 ,,	,,
2	1 in 12	8·7 ,,	47 ,,	$5\frac{3}{4}$ secs.
3	1 in 12	7·62 ,,	36 ,,	$4\frac{3}{4}$,,
4	1 in 40	6·63 ,,	9 ,,	2 ,,
Series II.				
5	(*a*) 1 in 40	18·6 ,,	65 ,,	$4\frac{1}{5}$,,
	(*b*) 1 in 40	18·5 ,,	61 ,,	Not recorded
6	1 in 40	15·5 ,,	$45\frac{1}{2}$,,	,,
7	1 in 40	7·2 ,,	$9\frac{1}{2}$,,	$1\frac{3}{5}$ secs.
8	1 in 77	4·15 ,,	$2\frac{1}{2}$,,	—
9	Level	6·2 ,,	$4\frac{1}{4}$,,	—
Series III.				
10	1 in 12	13·6 ,,	103 ,,	$7\frac{1}{2}$ secs.
11	1 in 12	9·5 ,,	40 ,,	5 ,,
12	1 in 12	7·7 ,,	25 ,,	$3\frac{1}{2}$,,
13	1 in 12	4·35 ,,	$8\frac{3}{4}$,,	—
Series IV.				
14	1 in 12	16 ,,	91 ,,	$6\frac{1}{2}$ secs.
15	1 in 12	12 ,,	48 ,,	5 ,,
16	1 in 12	10·4 ,,	33 ,,	3 ,,
17	(*a*) 1 in 12	8·15 ,,	16 ,,	—
	(*b*) 1 in 12	8·15 ,,	17 ,,	—

It will be observed that the last series is the best, and this is due to the brakes being in a rather less experimental state than they were previously. The curves give a fairly good idea of the action of the brake on different hills.



TESTS OF NEW EMERGENCY BRAKE.

This brake is applied by depressing a lever which is fixed on or near the controller, and requires no physical exertion. If it is applied before the controller is shut off, the circuit-breaker opens and the car is stopped as quickly as if the controller handle had been in the off position. The conductor can apply the brake at any moment, and even if the wheels should be skidding the action of the emergency brake is not affected.

When running back, a car can be held up instantly by the application of the leading brake.

During the trials one half of the brake was put out of action on several occasions, and the other half pulled up the car when travelling fast down a steep hill, but took rather longer to do it than if the whole brake had been in action.

All the tests helped to prove that a car could not overturn if the brake was applied before the actual moment of disaster had arrived, and this result is obtained without calling on the motors or straining the car.

The 1 in 12 grade was on a curve.

THERMIT RAIL-WELDING.

THIS system is not making anything like the progress in England which we were sanguine enough to anticipate after a careful study of its features, and of the recorded experience of presumably disinterested persons. This is the more surprising when we consider that there are several progressive lines scattered about the country which have demonstrated the real value of the cast weld in one form or another, but chiefly the weld by the Thermit process. It is to be regretted, therefore, that we should be still under the necessity of drawing testimony from abroad.

The chief characteristic of American technical journalism is its refusal to dwell on failures. Everything which it records is tinted with the rosy light of the morning sun, so that the foreign reader has acquired the habit of thinking that in the States the engineers are superhuman, and that nothing ever goes wrong. The exceptions to the rule go to the other extreme, and condemn everything trans-Atlantic as hasty-pudding unworthy of trial. As usual, the truth lies somewhere near midway, but the one certain cold fact stands out, that an exceptional degree of discrimination has to be exercised when reading foreign periodicals, for the simple reason that the *bona fides* of the writers cannot be gauged as accurately as we are accustomed to gauge the *bona fides* of our own home writers and editors. These reflections are not out of place when we are about to extract the juice from an article in an American exchange, but we hasten to add that they were written for the purpose of inducing our readers to believe that we realise this necessity for discrimination, and that what we here present as the experience of the Utica and Mohawk Valley Railway Co. bears the stamp of truth. As that experience has been favourable to the thermit weld, and as Utica is in the State of New York, where the climatic conditions are much more severe than in our latitudes, it is not too much to hope that a knowledge of it may lead to a more extended use of a system which offers mechanical and electrical advantages of no small order.

In seeming to insist on the merits of a particular proprietary process, we run a certain risk of criticism, but our attitude in this instance is inevitable, as the Thermit system is now in sole possession of the practical field of integrally continuous rails.

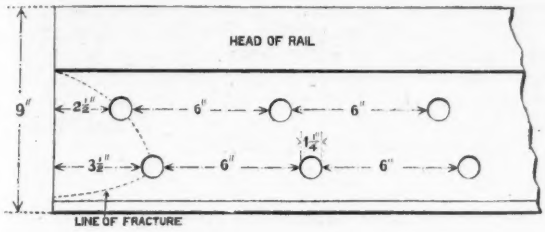
The Utica and Mohawk Valley Co. carried out the work themselves, and discovered that the best form of mould is made with an equal mixture of clay and sand, or preferably of sand and 10 per cent. of rye flour, which is baked at a temperature which does not burn the flour. This mixture comes away from the pattern without adhering, bakes without shrinkage, and is hard enough to stand ordinary handling. For special joints, a tea-spoonful of turpentine added makes the mould as hard as concrete.

The rail head, after heating with a torch, is painted with a watery solution of common red clay, which dries to a thin coating, and prevents the molten slag or steel from burning or welding to the head.

The crucibles are made of magnesia tar mixed with 25 per cent. of old crucible material, finely powdered. They are baked at a higher temperature than the moulds, and last for about 30 joints.

The rails are laid on timber sleepers set on 8 inches of crushed stone, and the track is paved with bricks on concrete, the depth of the sleepers.

Ten of the 600 joints made in the first year broke in the manner indicated below :—



This break is supposed to follow the line defining the limit of re-crystallisation produced by the heat conducted from the weld, and the immediate cause of fracture arose from the contraction of lengths of welded rail 500 to 600 ft. long which remained unpaved. This was overcome by omitting the weld at every sixth joint until the paving was finished, when closures were inserted at the temporary expansion joints and the final welds were made.

Four failures in the same year were due to bad welds, and afterwards every joint as it was made was tested by striking it with a heavy spike sledge.

In the second year there were seven more breaks through the bolt-holes in the 600 joints, and it is probable that this kind of fracture would not occur on new work in England where the rails had no bolt-holes, and the length exposed at any time was not excessive.

It was observed that the rail bumped sometimes when close butted joints were welded in the morning with rising temperature, and this was attributed to the latent compression in the rail, which did not manifest itself until the ends softened. The bumps were removed by grinding, and were prevented afterwards by welding on cooler days, or with a falling thermometer.

The best results were obtained with a clearance of $\frac{1}{16}$ in. to $\frac{1}{32}$ in., the expansion on welding making a perfect closure.

The idea that welding of any description permanently softens the rail ends is discounted by the statement that there has been no appreciable excess of wear near the welds, as the heated ends seem to cool down slowly in the same way as the rail does when coming from the rolls, thus restoring the temper.

Three hundred more welds were made in 1906 with even greater success, due to the elimination of the causes of previous defects, and the use of the process is to be continued; for if the breakage of joints does not exceed 2 per cent. per annum, and the life of the rail is 15 years, the cost per joint in paved track will be about 9s. 6d., and perfect stability with nearly perfect conductivity will have been obtained. Moreover, there is every reason to believe that breakages will decrease with time, as defective joints should manifest themselves in the first year or two of service.

The article from which these interesting particulars are taken appeared in the *Street Railway Journal* for January.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Central Station Supply Economics.

I shall be glad if you can find space for the following concrete example—avowedly an extreme case as regards the hours of supply—to illustrate my contention that, in order to obtain the much-desired "ideal" load, it would pay central station engineers to offer terms which, at first sight, may appear to them as almost ridiculous.

Let us assume that a group of large manufacturers, using, say, 5,000 H.P., were to offer to take electric power for the whole of their work, demanding this power only after midnight—*i.e.*, putting down and maintaining their own accumulators—if, in return they could obtain such power at the bare running expense, deduced as per my paper as regards coal, wages, repairs, &c., plus, say, £2,500 per annum for net profit. Would it not be advantageous to close with such an offer, especially as it would add 5,000 H.P. to existing connections and probably materially improve the load factor of the station? Or would it be better to lay down new plant and mains to the extent of 2,000 KW. at an expense of £150,000, and just succeed—perhaps not even this—in repaying interest on capital borrowed, without a penny to put by for reserve fund or to reduce the lighting rates of charge? The extra cost for current, on the terms of the manufacturers' offer, involves no speculation whatever on the part of the supply company, however poor a load factor the load may prove to have.

With regard to the above, I may say that I can show that the reduction which central station engineers could afford to give on such a load would warrant the consumers in putting down their own accumulators. It therefore now remains to be seen whether central station engineers consider such a load to be worth having.

A strong point in favour of the terms I suggest being practicable, is that the Newcastle Electric Supply Co. has made an offer to the Corporation to supply current at "non-peak" hours at the low figure of 0·384d. per unit, and this offer has been accepted.

Similarly, the London County Council recently proposed to supply the London municipal stations with current at "non-peak" hours at a price equivalent to about 0·35d. per unit, which, of course, would be *much* less where coal was cheap, as in Newcastle.

Again, Mr. J. P. Kemp's remarks at the discussion refer to a case, the details of which I am familiar with, and show that the actual cost was as low as 0·15d. per unit, for conditions of supply which are *almost identical* with my proposals.

A. M. Taylor.

King's Heath, *April 9th*, 1907.

Fancy Names for Lamps.

In your issue of April 5th under the above heading, Mr. W. A. Toppin states that "the present practice of calling lamps 'Brightlites,' 'Whytelites,' 'Tantalites,' 'Linolites,' &c., and, as a rule, omitting to mark on the lamp the candle-power and current taken, at the pressure stated, is to be condemned."

With this statement we quite agree, and as manufacturers of "Linolite" or "Tubolite" lamps, we have always endeavoured to do away with any annoyance to, or deception of, consumers, by stating, and keeping strictly to, a standard efficiency of 3·75 watts per candle, and marking every lamp with its respective voltage and candle-power. The difficulty of marking the lamps with the "current taken" in a system like "Tubolite," where on the higher voltages the lamps are run in series, has probably not presented itself to Mr. Toppin, and we should like to have his suggestions on this point, as we are ourselves as anxious as he can be to do away with anything that may be harmful to the progress of electric lighting.

The Linolite Co.,
R. L. Matthews, *Assistant Manager.*

Westminster, S.W., *April 16th*, 1907.

Cost of Living in South Africa.

I have been much interested—as I dare say have also many other readers of your paper in this country—in the article appearing in the issue dated February 22nd, under the heading "Cost of Living in South Africa."

There is, however, a serious omission in this article, in so far as the writer does not make it clear as to what class of individual he had in his mind when giving these details, and as the correctness, or otherwise, of the figures given depends entirely on this point, I take the liberty of calling the attention of your readers—especially home readers, who may be thinking of coming out to this country—to this matter.

When dealing with Cape Colony, your correspondent mentions mechanics and artisans, and in the paragraph relating to Rhodesia, he refers to locomotive drivers. Now, if the details given throughout the article are intended to apply to mechanics and the artisan class, then I am inclined to agree that the figures taken as a whole, are quite reliable, but they are absolutely misleading if intended to apply to any higher class.

Speaking generally, one would not be far out in reckoning the cost of the best "board and lodging" in the various Colonies mentioned, at about double the figures given by your correspondent.

The cost of living in Natal is stated to be "slightly cheaper" than in Cape Colony, but such a statement is hardly borne out by experience. According to your correspondent, the amount of "the clothing bill may be slightly reduced" in Natal, because of the warmer climate, but he has evidently not taken into consideration the extra amount of the laundry bill—which is a very serious item when washing suits are worn—nor has he allowed for the fact that in a hot, moist climate, one gets through a great many more clothes than in a cooler region.

Again, the disastrous effect of Johannesburg dust on one's clothing might have been mentioned, as adding very materially to the length of the "clothing bill" in that city.

I trust that these few remarks will suffice to show that unless details, such as those given in the article, are fully qualified, they are liable to mislead those whom they are probably most intended to help.

E. E. H.

Depreciation and Sinking Fund.

In the leading article in the REVIEW for April 12th, dealing with Mr. Leake's paper on "Depreciation of Productive Plant," you point out that the common practice of local authorities in making no provision for depreciation, on the theory that depreciation is provided for by the sinking fund, is fallacious.

How great a financial evil, this feature of municipal trading leads to is, I think, not generally recognised. The stolid reliance on the sinking fund which is displayed by the great majority of local authorities is wholly unjustified, especially where technical industries are concerned, for two reasons. In the first place, sinking fund does not provide for depreciation and obsolescence of plant, but merely pays off a small portion of the capital each year, extinguishing the capital at a far lower rate than the rate at which the plant as a whole depreciates. In the second place, a technical industry to be successful must be continuously developed, and can only be developed by continual capital expenditure. This causes the capital accounts of municipal trading enterprises to grow at a much more rapid rate than the sinking fund operates to reduce them. This effect is aided by the tendency of municipal trading to favour the working expenses at the expense of the capital account, charging everything possible to capital, so that there is generally both a natural and an artificial growth of the capital account, which puts the capital account of municipal trading concerns far ahead of any possibility of ever being overtaken by the sinking fund.

The net result of all this is that municipal trading has a steadily increasing capital account, and a capital account which grows steadily more unsound, because the assets do not represent the value, and steadily less and less represent the value at which they are carried. Thus millions and millions of money are annually poured into undertakings which are not remunerative when tested by commercial principles. This capital is withdrawn from private enterprise where it would be remunerative. The magnitude of the financial evil created by this steady waste of capital, and the extent of the injury done to the trade and industry of the whole country by the continuous placing of capital where it is inefficiently administered, and does not really earn an honest living, are not generally realised. But when the wave of Socialism, which has submerged the ignorant and unthinking, and swamped the more perspicuous section of the community, has passed, as it shows signs of doing, there will be a sad awakening.

Herbert Laws Webb.

London, S.W., *April 15th*, 1907.

Reunion of the E.E.R.E. (Vols.).

I have read with much pleasure and interest the letters in your valuable paper as to the possibility of a reunion of the S.A. contingent of the Electrical Engineers R.E.V. I have often thought that such a meeting would be extremely pleasant, and should be glad to give any assistance in my power to further the idea. If one or two old members, resident in or near London, would take up the suggestion, I fancy that, with the assistance of headquarters, a good number of the contingent could be reached, and a canvass on the idea taken.

G. Allason.

Loughborough, *April 10th*, 1907.

Battery Stands not Standard.

I enclose an extract from a specification *re* stands for a battery. The battery in question will consist of 136 cells having a capacity of 47 amperes for 10 hours, and is for a Union.

It seems disgraceful that money should be wasted in this manner, as a battery maker would have no hesitation in guaranteeing that ordinary wood stands would be quite satisfactory; further, the specification itself is exceedingly difficult to understand.

X.

Cells to be connected up and fixed in accumulator house on two-tier stand, provided and fixed by contractor. There must be sufficient room all round cells to facilitate inspection of same, and heights between consecutive rows of cells must be sufficient to allow of sections being easily removed from any cells whilst in position. Stand to consist essentially of large high-tension floor insulators, vertical wrought-iron screwed supports, and pitch pine scantling. Five pairs of porcelain insulators, slightly recessed into floor, to act as insulating feet, and be strong enough to resist actual crushing strains. Vertical shafts, 2 in. in diameter, to be slightly recessed into, and at bottoms supported by wide shoulder flanges on, these insulators. At heights of tiers from floor, the shafts to be screwed and nutted both sides of 4 in. square pitch pine horizontal supports, running both longitudinally and latitudinally. The structure must be made quite firm, and everything except insulators neatly painted with three thin coats of acid resisting paint before being put together, and two when fixed in position. Holes in insulators must be securely plugged up with ebonite on ground side to maintain insulation of this stand as high as possible. Height of second row of cells to be about 5 ft. from floor to centre of glass boxes. Bottom row of cells to be about 18 in. clear of floor level, but, in any case, sufficient space between rows to be left to comfortably remove sections.

Our Editorial Vagaries.

The enclosed cutting from your paper is characteristic of many of your utterances on the question of gas *versus* electricity, and, in my opinion, is so very ostrich like.

Neither you nor suppliers of electric current appear to realise that gas lighting is here to stay, and the lofty unconcern of electric light companies and the biting sarcasms of the electrical Press do not alter the fact that gas is beating electric light "out of sight," and always will while energy is charged for at 6d. per unit. I have in my house and works both gas and electric light, the latter both from a supply company and generated by my own plant, so I claim to know something about it.

If you would abandon your lofty tone, and endeavour to help the electrical world to realise that in gas they have a very serious competitor, which they cannot afford to ignore, you will be doing the electrical trade a far greater service than by stiffening their necks by talking about "the straits to which the gas industry is put," &c., even allowing you every opportunity for a display of humour.

In case you may think I am interested in gas, kindly note that my future is wrapped up in electricity.

C. S.

[The cutting in question is a recent paragraph on a French patent, covering the use of an egg-shell as an incandescent gas mantle. We feel very bashful about it. Truth to tell, it was meant to be funny, and we feel as if we had been caught giggling at a funeral. We know that life is real and earnest, but we can't help breaking out at times, in a mild way, though we may—and often do—feel sorry for it afterwards.

We have a dim suspicion that our correspondent himself is poking fun at us; certainly the attention that we have given in our columns to the question of competition with gas,

during the last six months, has been greater than in any previous period in our history, and perhaps has erred on the side of excess. If "C. S." read the ELECTRICAL REVIEW, he could not fail to note our long series of notes on commercial development of electricity supply, articles on competition with gas, and similar references to the subject. He would also discover that in a large number of towns electrical energy is supplied at a price between 3d. and 4d. per unit for lighting.—EDS. E.R.]

NEW WIRING RULES OF THE I.E.E.

THE principal additions to these Rules, apart from extracts from Government Regulations are: a section on Bare Conductors (par. 52); three new Definitions (pars. 12-14); pars. 27, 29, 45, 46 (*c*), 47, 48, 51, 56, 64, 67, 86, 89, 94, 95 and 96, and the Wire Table. Important additions have been made in many other places, and several significant omissions have been made, to which attention is drawn below. The new Table of particulars relating to Insulated Copper Conductors contains much matter derived from the E.S.C. Standard Tables, and is fundamentally different from the former Table. In what follows the number of the old paragraph is given in brackets, and where quotations are given, either the whole, or the part in italics is new.

INTRODUCTION.—1. The references to 500 volts pressure and to alternating currents have been omitted; instead, the reader is referred to the B. of T. Regulations for medium pressures (250-650 volts) given on a later page.

2. It is recommended that suggestions emanating from the fire offices insuring the risk be adopted.

DEFINITIONS.—Besides slight changes in pars. 3 [104], 4 [101], 5 [104] note, and 6 [99], new paragraphs have been inserted:—

12. A cable is said to be of I.E.E. 600, or 2,500-megohm grade, when its minimum insulation is that shown in cols. 5 and 6 respectively of the table when tested at 60° F. (15·6° C.), after one minute's electrification and 24 hours' immersion in water.

13. A ventilated motor is one in which, while ventilation is provided for, access to the armature, field coils and other live parts is only to be obtained by opening a door in, or removing a part of, the enclosing case.

14. A totally enclosed motor is one in which all the live parts whether insulated or not, are totally enclosed, as in paragraph 13, but without provision for internal ventilation.

GENERAL ARRANGEMENT.—15 [7]. Linked switch-fuses are permitted. 17 [6]. "No fuse may be placed in the neutral conductor of a three-wire *or other multiple-wire* system. . . ."

19 [11]. When all three wires or two pairs of wires are brought into premises, the supply is to be given to two pairs of terminals arranged so as to minimise the danger of shock, and the wiring from these terminals is to be kept distinct throughout. The same principle is applied to other multiple-wire systems.

20 [10]. Two-phase system added, and triple-pole circuit-breaker allowed.

21 [3]. For sub-circuit read *final* sub-circuit. Heater sub-circuits are added, carrying up to 15 amperes up to 125 volts, or 10 amperes from 125 to 250 volts, with a fuse on each pole.

24 [12]. The stipulation that conductors at pressures above 250 volts must be enclosed in metallic sheathing is omitted. The earth-wire must be of copper, not less than No. 14 S.W.G.

25 [15]. "There must be no contact between conductors (*or their insulating material, metallic sheathing or tubing*) and gas pipes."

27. Where concentric wiring with an earthed external conductor is used, it must be used throughout, except for fittings and pendant flexibles.

29. Where inflammable gases, &c., may be present, dynamos, arc lamps, Nernst lamps and connectors are prohibited, and incandescent lamps with their holders must be enclosed in air-tight fittings, switches, fuses, resistances and motors must also be enclosed.

30 [13 and 55]. "*Except where completely enclosed in a metallic casing*, no switch, *ceiling-rose*, cut out," &c., may be mounted directly on a surface of a humid nature.

CONDUCTORS—SIZE AND CONDUCTIVITY.—18 is omitted.

31 [21]. Reference to flexibles is omitted. "It must be assumed that at least 60 watts may be consumed at any point."

33 [20]. The E.S.C. standard is introduced.

34 is part of [21].

35 [22]. The volt-drop given in the Table is specified for *continuous* current only.

CONDUCTORS—INSULATION.—36 [23]. The limiting temperature for paper or fibre insulation is raised to 176° F. (80° C.) and the reference to "specially hot places" is deleted.

37 [24]. For Class A cables vulcanised rubber dielectric is suggested; for Class B, paper or fibre.

38 [25]. The rule for thickness of dielectrics is replaced by standard given in the Table.

39 [27]. The period of test at 2,000 volts is raised from 10 minutes to half an hour, and the bending test is omitted. Alternating pressure of 50 cycles, preferably sinusoidal, is specified for the test.

40 [28]. The minimum insulation resistances for V.R. cable are materially increased, nearly double for up to 250 volts (600 to 2,000 megohms per mile), and standards are introduced for 250—650 volts (2,500 to 5,000 megohms per mile). 41 represents [94]. 42 is part of [29], strengthened by altering may to must.

CONDUCTORS—FLEXIBLE.—44 and 45 [34]. Here there are considerable alterations. The minimum sectional area allowed for flexibles is given as that of No. 22 S.W.G., and the smallest gauge of wire used is No. 36 S.W.G. "Pure rubber" is amplified by the words "equal to washed Para rubber of the best quality," and is recommended for pendant flexibles. "Vulcanised rubber flexible must be insulated with one layer of pure rubber, and two layers of vulcanised rubber, and the radial thickness of the dielectric must not be less than 34 mils." The V.R. flexible is raised to 1,500 volts at 50 cycles for 15 minutes after 24 hours' immersion in water, and the vapour-of-boiling-water test is omitted. In 45, flexible is allowed for sub-circuits, except where passing through floors; it must be protected by incombustible watertight conduits where it passes through walls. "Connection between flexibles and hard wires may only be effected by means of screw-down terminals in junction boxes or ceiling roses, and where flexibles from fittings must pass into a ceiling they must be enclosed in conduits up to a metal junction box."

CONDUCTORS—FIXING AND SUPPORTING.—46 (*a*) mainly follows [29], the E.S.C. Standards for steel conduits being adopted. "In dry places isolated single lengths of tubing need not be earthed if adequately enamelled, or otherwise insulated, externally."

46 (*b*) follows [41], but adds that "conductors carrying more than 5 amperes must be laid singly in separate grooves" in wood casing.

46 (*c*) is an important new clause, which we give in full:—(Insulated conductors) "may be without mechanical protection (*i.e.*, without conduit, armouring, &c.) where not exposed to injury, but they must be supported in such a manner as to secure the permanent spacing of the conductors from walls, ceilings and all structural metal work and metal piping. When carrying more than 5 amperes, they must also be spaced from each other, unless they are of the multiple-core or concentric types. Such spacing is not, however, necessary if the conductors are lead covered." The words "excepting flexibles" occur in the first line of the rule, but, on the other hand, flexibles are specifically allowed for by par 45—"Flexibles . . . may be used . . . for sub-circuits under the conditions of paragraph 46 (*c*)." Hence the Continental system of running flexibles on insulators has now received official sanction, though we believe that it is being regarded with growing disfavour in Germany.

47 and 48 are new; 47 relates to unenclosed lead-covered conductors, which must be supported on a continuous wood fillet, or fastened by broad clips, while 48 requires conductors passing through floors, walls, &c., to be specially protected. 49 [40] strengthens 48 in connection with party-walls and fire-resisting floors; the tubes must now be close-fitting instead of being filled up solid as formerly. 50 [39] requires mechanical protection for conductors buried in plaster, but it need no longer be of sufficient strength to resist a nail. 51 prohibits metal staples on unarmoured conductors.

CONDUCTORS—BARE.—52 opens with the tautological statement, "Bare conductors without any insulating covering may be used indoors," and goes on to detail the uses to which they may be applied—viz., as collector wires for travelling cranes, &c.; as trolley wires for locomotives and jib cranes; as battery connections; and for other purposes, with appropriate precautions in each case, in positions inaccessible to unauthorised persons, and subject to permission from the Fire Offices concerned.

JOINTS AND CONNECTIONS.—This section has undergone but little change. 56 is a new clause recommending looping to avoid joints on small conductors.

SWITCH AND DISTRIBUTION BOARDS.—61 [56] now provides against fire spreading at both the front and the back of the boards, and has been rewritten. In 66 [60] to voltmeter is added pilot lamp. 67 is new: "Combination switch and fuse boxes must be so arranged that it is possible to operate a switch without uncovering the fuses, if of the open type." In 68 [46] the clearance from glass cover to fuse is reduced from 2 to 1 in., but if the cover is wood it must be protected with fire-resisting material, with a clearance of 1½ in.

SWITCHES.—This section is little changed. 69 [45 and 17] omits [45] (*c*), partial contact; (*f*), pressures over 250 volts; and (*h*), which said "It must not contain a fuse." On the other hand, it provides that for more than 5 amperes, at pressures over 125 volts, metal covers must be lined; that switches exposed to injury or to contact with goods must be guarded; and that the hand cannot be injured by the blowing of an adjacent fuse.

FUSES.—The maximum steady current may now, according to 70 [46, 47 and 51], exceed the normal rate by 200 per cent., instead of 100, before blowing the fuse. Arcing must be prevented. Small close-fitting covers should be perforated. The prohibition against the presence of fuses in switch-covers is removed. 72 [48 and 49] recommends precaution against shock when feeling whether a fuse is warm.

CONNECTORS.—73 [50]. Fixed connectors must have incombustible bases, and be suitable for easy inspection. 76 [54]. Every connector or group of connectors must be controlled by a switch on the live side, and the portable fittings should be without switches.

CEILING ROSES.—77 [55] (*d*). Must not be used for more than two pairs of flexibles unless specially designed.

FITTINGS FOR SUPPORTING LAMPS.—Practically unchanged.

LAMP-HOLDERS.—82 [65]. The much-discussed clause requiring

them to be insulated from conduit is omitted; they must not contain a switch when used for pressures over 250 volts.

Arc Lamps.—84 [67]. Permission is given to use arc lamps without globes for photography, &c., but the flooring must be incombustible. Open inverted arcs must have metal reflectors projecting at least 15 in. horizontally beyond the arc on all sides.

Incandescent Lamps.—85 [68]. Lamps must be specially protected when placed close to combustible materials; combustible shades must be kept clear of the holders; celluloid must not be used for candle tubes. 86. "Lamp caps, of which the insulating material is hygroscopic, must not be used in damp places unless the lamp-holder is insulated from its support." And not even then, we suggest.

Heaters.—This term now covers also cooking appliances. By par. 89 radiator circuits must be protected by a fuse on each pole and by a wall-switch in each room.

Resistances, Choking Coils and a.c. Transformers.—These are now lumped together in par. 90 [71], the special paragraphs [75 and 76] relating to transformers being dropped. Finely perforated sheet-metal is admitted as alternative to wire gauze; the limiting temperature of the resistance wires is omitted, and that of the cases raised to 176° F.

Motors.—91 [70]. When mounted on or over wood flooring, unless totally enclosed or ventilated, they must be separated from the floor by a sheet of metal. In positions exposed to inflammable dust, &c., motors must be totally enclosed or of the ventilated type. All slip rings, commutators, and brushes must be totally enclosed, though induction motors without slip-rings may have open ventilating holes. A switch and fuse, hand-grip fuse or circuit-breaker must be used on one conductor, and one of these on the other. d.c. motors must have regulating switches and starting resistances, and the shunt circuit *must* be so connected that the field is excited before the armature. a.c. motors must have starting devices and no-volt release, with linked circuit-breakers on the conductors in the case of large motors.

Dynamos.—92 [70]. Must not be placed in positions exposed to inflammable dust, &c. The protection of wood flooring and the control with switch and fuse are the same as for motors.

Accumulators and Other Batteries.—94. The case of each cell must stand on insulators. 95. Bare conductors should be used for end and regulating-cell connections, and all regulating cells must be protected by a fusible connector at each cell.

Testing.—This section is not materially altered; but the "30-watt lamps" [79] are replaced simply by "lamps," and the measure of arc lamps in terms of these is abolished. The minimum insulation resistance of any sub-circuit is one megohm; *any* motor or other appliance may be connected if the insulation from the frame of the parts carrying current is greater than one megohm.

99 [80]. It is no longer recommended that the negative pole be connected with the conductor under test.

100 [81] wisely provides, not merely that repairs must not be made when the pressure is on, but that the circuits must first be "*entirely disconnected from the supply.*"

Table.—This is a great improvement on the old table, being much better arranged and more informative, while the columns relating to hot places are replaced by others more generally useful. A table for flexibles is added, and the E.S.C. standards for copper conductors are given in par. 113, these being practically identical with the standards of the Committee on Copper Conductors.

The rest of the work consists of the B. of T. Regulations for medium pressures, so far as they apply to motors, arc and incandescent lamps in series, and the wiring and accessories used in connection with them; and the Home Office Special Rules for Mines.

The index is omitted from this edition; this is a mistake, and we hope that it will be rectified in the next issue.

LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.*]

No. 75.—Electricity Supply.—Towns joining together.

"Enquirer" writes:—"I should be pleased if you could kindly inform me if there is any special legal agreement necessary in the case of two or more towns combining to have one joint electricity supply and tramways scheme, such for instance as the Hyde, Stalybridge and Mossley scheme.

"If any special legal agreement is necessary, could you tell me what are the main features embodied in it, and how profits, losses, &c., are shared between the combined towns?

"Are they determined on the rateable values, or in what way?

"In the case of tramway receipts, would it be more equitable to apportion profits, losses, &c., on the car mileage in each borough, in the case of electricity supply, on the demand of each borough, rather than on the rateable values?

"With regard to *maintenance* of permanent way, mains, &c., would each borough meet the cost for this item within its own boundary, or would it be better to have a joint board which would have the administration of the whole scheme, the various boroughs dividing the expenses, &c., as hereinbefore mentioned?

"Further, what course would have to be pursued by these towns to obtain borrowing powers, and if each or any one town has already obtained certain borrowing powers, which together are insufficient for the combined scheme, how could these be united in the joint scheme and the excess borrowing powers obtained?

"In the case of assessment for rates, as the generating station can only be situated within one borough, would that borough be justified in rating and drawing the rates on the generating station at the figure obtaining in that borough, and what provision would have to be made for the rating of the tramway permanent way in the various boroughs?

"Do you know of any other towns that have combined similarly to Hyde, Stalybridge and Mossley? If so, I should be pleased to know of them, and any special features in their agreements of which you may be cognisant.

"The above case assumes that each town has its own electricity supply and tramways order. Would there be any different method of procedure in case one or more towns were without electricity supply and tramways orders?"

*** The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Act, 1901 (1 Edw. vii, ccxcv), is the only illustration of the combination of several small local authorities for the purpose of carrying out schemes involving the generating and distributing of electrical energy with which we are familiar. That Act constituted a joint board, consisting of representatives from the various councils interested, and authorised the taking of land compulsorily for the purposes of the Act, and the construction of tramways to serve the districts interested, to be worked electrically. The Act also incorporated the Schedule to the Electric Lighting (Clauses) Act, 1899 (with the exception of certain sections), and made special provision for the application of tramway and electricity revenues respectively. So far as is known, an agreement between two local authorities to run tramways and supply electricity can only be carried out with the authority and sanction of Parliament. It is impossible to say what the main features of such an agreement would be. As to the other queries put by "Enquirer," these are more of practical than legal interest, and could be better answered by one who is familiar with the high finance of electrical undertakings.

PARLIAMENTARY.

Rawtenstall Corporation Tramways.

The Police and Sanitary Committee, under the chairmanship of Mr. Corrie Grant, which considered the Rawtenstall Corporation Bill some weeks ago, has issued its report to the House. The report states:—

The Bill authorises the Corporation of Rawtenstall to acquire, reconstruct, and equip for working by electrical traction, certain tramways beyond the Borough of Rawtenstall—namely, in the Borough of Bacup. Such tramways will be in connection with the tramways authorised to be reconstructed for working by electrical traction by the Corporation within the limits of their district, and the Committee have caused provisions to be inserted in the Bill whereby such powers shall only be exercised by the Rawtenstall Corporation in the event of the Bacup Corporation failing within periods specified in the Bill to acquire, reconstruct and equip such tramways themselves. The Committee have also caused to be inserted in the Bill provisions whereby, upon and in certain specified terms and events, such tramways will be leased by the Bacup Corporation to the Rawtenstall Corporation. The Committee are of opinion that, having regard to the special local circumstances, such acquisition, reconstruction and working by the Rawtenstall Corporation, or in the alternative such lease by the Bacup Corporation to the Rawtenstall Corporation, and the working by the latter ought to be allowed. The length of such tramways so situate beyond the limits of the Borough of Rawtenstall is 2 miles 3 furlongs 1·40 chains. That inasmuch as Part III (which includes Sec. 43) of the Tramways Act, 1870, is incorporated with the Bill, the Committee have not inserted any special clause for the local authority under the said Act of the district consisting of the said Borough of Bacup in the terms of the said Sec. 43, but have in the special circumstances of the case substituted a period of 30 years for the period of 21 years mentioned in that section. In pursuance of the resolution of the House of February 26th last, the Committee have struck out of the Bill the powers to construct Tramways Nos. 10, 11 and 11a. That in pursuance of Standing Order No. 145a, a report from the Board of Trade was laid before the Committee with reference to the tolls, rates and charges proposed to be authorised by the Bill, from which it appeared that the proposed maximum rates and charges are not in excess of those usually authorised by Parliament in respect of like undertakings, and the Committee are, therefore, of opinion that they may be sanctioned. That the Committee have allowed seven years for the completion of the new tramways to be authorised by the Bill, having regard to the fact that it is not expedient that they should be commenced until the existing tramways in the borough have been acquired by the Corporation and equipped for working by electrical traction, to the desirability of testing the traffic on the new route by means of omnibuses, and to the fact that eight years were granted in similar circumstances by the Committee in the year 1906 to the neighbouring borough of Haslingden, for tramways which will be worked in connection with these tramways.

The Committee has allowed the following periods for the repayment of loans:—Sum necessary for the purchase of the Accrington tramways, 25 years; £8,900 for reconstruction of Accrington tramways, 30 years; sum necessary for purchase of Rossendale tramways, 25 years; £32,300 for reconstruction of Rossendale tramways, 30 years; sum necessary for purchase of Bacup tramways, 25 years: £17,600 for reconstruction of Bacup tramways, 30 years; £14,000 for construction of new tramways, 30 years; £30,100 for electrical equipment of tramways, 20 years; £11,500 for purchase of rolling stock for tramways, 10 years; £3,500 for provision and running of motor-omnibuses, 5 years.

Post Office Telephone Staff.—Replying to Sir John Baker in the Parliamentary papers, Mr. Buxton states that the question of placing the male clerical staff of the general manager of the Post Office London Telephone Service on the establishment is now being proceeded with, but the matter requires careful investigation for consideration, and some little time is necessary for the completion of the scheme.

Richmond (Surrey) Electricity Supply Bill.—We understand that the facts in connection with the Richmond Company's Bill were not correctly described on page 554 of our issue of April 5th. Under the Bill the promoters, that is the company, are made undertakers instead of contractors as they were formerly; our note stated that the promoters were not to act as undertakers, which was not the case. Further, we learn that there is nothing in the Bill preventing the company promoting any Bills in Parliament without the consent of the Corporation.

Watford and Edgware Railway Bill.—On Thursday last week the Examiner of Standing Orders in the House of Commons had before him the new provisions which the Watford and Edgware Railway Company are seeking to have inserted in their Bill this session. The new powers sought are for the construction of a junction line about half a mile long to connect the authorised line with the Great Northern Railway, Edgware branch, and to enter into working agreements. A formal decision of "non-compliance" was given. [It is now reported that the petition for the additional provisions has been withdrawn.]

West Riding Tramways Bill.—It is announced that all opposition to this Bill has been withdrawn.

Kingston-on-Hull Corporation Bill. — After several days' consideration Mr. Corrie Grant's Select Committee of the House of Commons has found the preamble of the Hull Corporation Bill proved. Power is taken under the Bill to construct a tramway in Charlotte Street and to equip the same. The opposition was directed to the clauses for the purchase by the Corporation of the local gas company, and in opening on this part of the Bill the Hon. J. D. Fitzgerald, K.C., mentioned that in six years the Corporation had made £81,000 profit on tramways, while the electricity undertaking was being carried on at a profit, although nothing had been applied in relief of rates.

Manchester Corporation Tramways Bill.—In the House of Lords on Monday this Bill was read a third time and passed.

London Power Bills.—On 9th inst., in the House of Commons papers, both the Administrative County of London and District Electric Power Bill and the L.C.C. (Electric Supply) Bill were down for second reading, but this stage was further adjourned until the 25th inst.

Tramcar Brakes.—In the House of Commons last week the President of the Board of Trade (Mr. Lloyd-George), in reply to a question, said he was aware that there had been several fatal accidents within the last eighteen months due to tramcars running away or leaving the rails, and that in some cases the brake mechanism was in fault. The whole question of tramway braking appliances was at present being investigated by Committees appointed by the Tramways and Light Railways Association and the Municipal Tramways Association respectively, and the Board of Trade had expressed their willingness to assist in a joint inquiry at a later stage.

North Metropolitan Electric Power Supply Bill.—In the House of Commons on Tuesday, this Bill was read a second time.

Electric Supply Corporation Bill.—The Lord Chairman of Committee has reported that all opposition to this Bill has been withdrawn.

BUSINESS NOTES.

Bellamy v. Wakefield and District Light Railway Co.—This case was on Tuesday in the list for hearing before Mr. Justice Joyce in the Chancery Division of the High Court. Before the case was reached, Mr. Hughes, K.C., said it was a motion by the plaintiff to restrain the defendants from committing a nuisance. With his Lordship's sanction, it had been agreed that the motion should stand over for two months, and then probably his Lordship would not be troubled with it at all. In the result it was arranged that the motion should be put in the paper again on June 17th next, subject to anything part heard.

Catalogues and Lists.—The North-Western Electrical Appliance Co., Railway Appliances Works, Cathcart, Glasgow.—Revised catalogue (12 pages) relating to their arc lamp lowering gear. It contains fully-illustrated details of the firm's contact-suspension appliances, patent cable protector chain for Swan-neck brackets, and automatic winch specialities, describing certain improvements and additions that have been made therein since they were shown in our pages. Copies of the list will be sent to anyone interested.

Messrs. Simplex Conduits, Ltd., Birmingham and London.—Small 16 pp. pamphlet entitled "The Real Truth About Enamel," containing some particulars of the tests carried out by Mr. J. Hewett, M.I.E.E., on their enamel for Simplex conduits.

Messrs. John Davis & Son (Derby), Ltd., All Saints' Works, Derby.—New section (071 B) entitled "Power and Lighting Accessories," wherein are briefly handled and illustrated their motor-starters, panels, switches, fuses, circuit-breakers, junction boxes, and other apparatus required in connection with the distribution of electric light and power in collieries. Prices are given.

Messrs. Johnson & Phillips, Ltd., Charlton.—New instrument price list (M.I.) containing illustrated description, code words and prices of their dead-beat moving iron ammeters and voltmeters in iron cases, for continuous and alternating currents. Also two new booklets, one containing a description of their standard oil-cooled transformers, of which they are now able to give quick delivery; the other being a collection of photographic illustrations of some of the different types of switchboards that they have recently constructed for lighting and traction station and factory use.

Messrs. Elliott Bros., Century Works, Lewisham, S.E.—Pamphlet (A.C. 84) containing a fully-illustrated description with line diagrams and half-tone views, also lists of prices, of their A.C. instruments—three-phase wattmeters of portable and switchboard types. Also a pamphlet (G. 98) containing many illustrations and brief well-arranged particulars, prices and code-words, of their galvanometers, including shunts, scale stands, lamps and accessories.

Messrs. De Dion Bouton, Ltd., London, W.—New booklet entitled "Motor Vehicles for Commercial Travellers," in which are given descriptions of a number of vehicles supplied by them for this class of service.

Messrs. D. Santoni & Co. (1906), Ltd., London, E.C.—New list "W" particularising their cable and flex.

Messrs. James Archdale & Co., Ltd., Manchester Works, Ledsam Street, Birmingham.—Section catalogue of high speed radial drilling machines, giving some large finely executed illustrations of these machines, together with full particulars of same; also dealing similarly with a combined sensitive and radial drilling machine, and a new design of machine which has been specially built for high speed drilling.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—New publication (No. 1,002) just issued entitled "Heating and Ventilating." It is very finely—indeed, almost lavishly—got up, a good art paper being used throughout in order to show off the illustrations to best advantage. It is divided into four sections. The first contains a good deal of information concerning the various types of Sirocco apparatus, while the following ones relate respectively to the heating and ventilating of industrial and public buildings, and ship ventilation.

The Sterling Telephone and Electric Co., London, E.C.—Pamphlet No. 130, containing illustrated particulars and prices of "Single Lever" automatic intercommunication telephones; also list No 131, of the company's No. S6125 electric motor bell.

Dissolutions and Liquidations.—The Motor and Electrical Engineering Co. (Leeds), Ltd.—A meeting is to be held at Central Bank Chambers, Infirmary Street, Leeds, on May 24th, to hear an account of the winding-up from the liquidator, Mr. R. A. Smithson.

Hillgrove and Armidale Electrical Corporation, Ltd.—A meeting is to be held on May 16th, at 15, South Street, Finsbury, to hear an account of the winding-up from the liquidator, Mr. S. W. Money.

Aublet, Harry & Co., Ltd., laundry and electrical engineers, Curtain Road, E.C.—Mr. Charles Comins has been appointed liquidator of this company, which has gone into voluntary liquidation. Pending the sale of assets, he will carry on the business.

Improved Electric Supplies, Ltd.—An order for winding this company up compulsorily was made by Mr. Justice Warrington on Tuesday. The petition was presented by Krupka & Jacoby, who were creditors for £373 for goods supplied. The company was the successor of two somewhat similar companies. There was an issued capital of £10,000. Of that, £9,994 was held by Mr. Walter Chamber, the remainder being issued to the subscribers for cash, which was the only cash capital the company had. In August, 1905, a debenture for £4,000 was issued, and in October another for £2,500 to Mr. Walter Chamber, who was also a director. In the voluntary winding up the liquidator was receiver for the debenture-holders. Application had been made to him, but he had given no information with respect to the value of the assets. There was a large number of unsecured creditors, and unsecured creditors to the amount of £2,000 supported this petition.

British Electric Equipment Co., Ltd.—A compulsory winding-up order was made on Tuesday in Mr. Justice Warrington's Court.

Raymond Phillips Electric Railway and Tramway Equipment Co., Ltd.—A meeting is to be held at 9 and 10, Fenchurch Street, E.C., on May 27th, to hear an account of the winding-up from the liquidator, Mr. Philip Mordant.

Trade Announcements.—Mr. John H. Harpin has just relinquished his position as manager for the Alliance Electrical Co., at their Birmingham depôt, in order to commence business as John H. Harpin & Co., electric lighting and power engineers, at 47, Temple Row, Birmingham. Copies of manufacturers' lists are invited.

With reference to the notice on p. 556 of our April 5th issue *re* the London Branch of The Electrical Co., Ltd., we are now asked to state that the Yorkshire district is not controlled by this branch.

The Union Electric Co., Ltd., have increased their number of telephone exchange lines, and established an isolated exchange at their London office for serving the different departments. The number for all is "Hop" 2,970.

Messrs. Roger Dawson, Ltd., of 8, Berners Street, W., have purchased the whole of the premises known as No. 1, Berners Street, until lately occupied by Messrs. Novello & Co., Ltd., music publishers. The ground floor is 52 ft. wide by 100 ft. deep, and this portion of the building is being fitted up as electric light showrooms. Four floors of offices are to be let off to tenants.

The London Electrical Fittings Co., Ltd., wish the trade to know that their new showrooms at 15, Newman Street (first floor), Oxford Street, W., are now open.

Victoria.—A new market is open for manufacturers of electric plant in the Bendigo district. It has been decided to work the Tronbank Hill mines below the 3,000-ft. level, and to equip some of these mines to enable them to go down to 5,000-ft. level. It is proposed to electrify the plant and to work the winding and other machinery from power to be obtained from the electric supply company.

Electrical Apparatus for Canada.—*Canada* states :—"The Commercial Agent has recently furnished special reports to the Canadian Government on the subject of electrical apparatus. It is remarkable that Great Britain is making a very poor show under this head, its contribution last year out of half a million's worth of goods imported into the Dominion being only about £13,000. The case was worse with regard to electric motors, dynamos, &c., of which Great Britain's contribution only totalled £2,250 out of £200,000. In this case it is well known that the question is not one of price, because, in other markets, America, the principal competitor, has been handsomely beaten. It seems to be a case rather of inability or unwillingness to adopt Canadian ideas, and especially to work to their gauges. This can easily be done if the Britisher makes up his mind to get well into the market."

Cryselco Lamps.—We understand that contracts for the year 1907 have been placed with CRYSELCO, LTD., by the General Post Office, the L.C.C. Tramways, Sheffield Corporation Tramways, Edinburgh and District Tramways, the Corporations of Dewsbury, Salford, West Ham and Wigan, and the Mersey Docks and Harbour Board.

Roller Bearings.—Amongst the recent orders received by THE EMPIRE ROLLER BEARINGS CO., LTD., for their patent roller bearing axle-boxes, are :—The fitting of 25 additional tramcars for the Brazilian Tramways; from the Madras Railway Co., for bearings for their main-line rolling stock; a further supply for Calcutta rolling stock, and for the fitting of new cars for the Liverpool Corporation Tramways, the Great Grimsby Tramways, and additional bearings for the Lancashire and Yorkshire Railway Co.

Brush Contracts.—The following contracts have been placed with the BRUSH ELECTRICAL ENGINEERING CO., LTD. :—

For the Electric Lighting and Traction Co., of Australia (for Melbourne), 1,500-KW. Brush-Parsons turbine and 4,000-volt monophase alternator.

For the Auckland Electric Tramways Co., 600-KW. Brush-Falcon reciprocating engine and traction dynamo.

Engineering in Persia.—The *Engineer* says :—"Inquiries are frequently being made by British engineering, electrical and other firms as to openings for the introduction of machinery into the Persian market. There is practically no opening for large, heavy or complicated machinery, nor will there be until better roads are made, or until railways are introduced."

Italy.—La Societa Tramvie Elettriche Briantée is the name of a new company which has just been formed at Monza, with a capital of £36,000, to construct and work a system of electric tramways in the district.

Spain.—The Sociedad La Industria Elettrica, of Barcelona, is increasing its capital to £100,000, with the view of enlarging its electrical engineering works in that city.

Greece.—The balance-sheet of La Compagnie Hellenique d'Electricité Thomson-Houston for the last financial year shows a profit of £27,172.

Book Notices.—"Transactions of the American Electro-Chemical Society." Vol. X. Philadelphia: published by the Society. 1906. $3 00.

"Testing of Alternating-Current Machines." By C. Kinzbrunner. London; Harper & Bros. 4s. 6d. net.

"Annual Report of the Smithsonian Institution, 1905." Washington Government Printing Office.

Partnership.—Mr. Sydney O. Hoad and Mr. Frank P. Spicer have joined in partnership to carry on and extend the old-established business of C. LARKINS & Co., electrical and general engineers and contractors, Bush Lane House, Cannon Street, E.C. Mr. S. O. Hoad has been connected with the firm since its commencement in 1892, and for the past six years has successfully managed the concern. Mr. F. P. Spicer has, during the last 8½ years, been with Messrs. Mather & Platt, Ltd. The name of C. Larkins & Co. will be retained.

LIGHTING and POWER NOTES.

Beverley.—The B. of T. has given notice of the revocation of the Beverley Electric Lighting Order, 1901, as from April 3rd, 1907.

Caerphilly.—The South Wales Electrical Power Co. has informed the U.D.C. that there is no probability of its being able to carry out the provisions of the agreement for E.L. between itself and the Council.

Carmarthen.—The T.C. has accepted the offer of Messrs. Saunders & Co., of Cardiff, to light the town by electricity. The terms were lower than those of the gas company.

Canada.—WINNIPEG.—Sixty-five miles from this city, at Lac du Bonnet, is installed one of the most modern water power plants in Canada, giving some 30,000 H.P. To maintain the levels the year round, the water was backed 8 miles above the power house by means of a coffer dam, to an average elevation of about 8 ft. The main units in the power house consists of four 1,000-KW. and five 2,000 KW. revolving field 60-cycle, 2,300-volt three-phase generators, coupled to turbines; 100-KW. 125-volt direct-current exciters, coupled to turbines; and three 175-KW. 125-volt exciters, coupled to three-phase 2,300-volt induction motors. The switches are sectional, and are enclosed in masonry. There are 15 transformers, comprising two banks of 1,100 H.P., and three banks of 2,400 H.P. The pressure is stepped up to 60,000 volts for transmission to a sub-station at Winnipeg, a distance of 65 miles. From the power house are run duplicate transmission lines on steel towers. The line crosses the Winnipeg River with a span of 760 ft. on 72-ft. towers; the standard towers are spaced 500 ft. apart, and are 40 ft high The cost of the complete plant will amount to about $4,000,000, and it is believed that this scheme will make Winnipeg commercially possible as a manufacturing centre, as, owing to the high cost of fuel, steam power plants are economically impossible.

TORONTO.—The application of the City Council for powers to expropriate the Toronto Electric Light Co. has been refused by the Provincial Parliament, and the contract of the company in question with the Electrical Development Co., of Ontario, for the supply of energy from Niagara, has been confirmed.

Cheltenham.—A L.G.B. inquiry was held on April 9th into the application of the T.C. for a loan of £6,825 for additional plant for the electricity works. A ratepayer opposed on the ground that the plant was required for the benefit of certain private consumers only, but the Inspector (Mr. Meade King) disputed this view.

Continental Notes. — GERMANY. — H.M. Chargé d'Affaires at Darmstadt (Mr. F. D. Harford, C.V.O.), reports that negotiations have been proceeding for several years past between the Baden and Swiss authorities for the utilisation of the falls on the Rhine on their frontier between Rheinfelden and Augst, by the erection of a power station for the generation of electricity by turbines. It appears now that the District Council of Lörrach, in Baden, has approved of the scheme, so that its execution may be looked upon as assured. The undertaking is called the Augst-Wyhlen power station, and the concessionaires are the canton of the City of Basle and the power-station works of Rheinfelden (Baden), which latter works already produce 15,000 H.P., but for the past six years have been obliged to draw largely upon the Swiss power station at Bettlau. It is expected that the projected power station will produce 24,800 H.P. when the Rhine is very low, and 30,000 H.P. when the level is higher. The weir will be so arranged that the works at the same time form separate Baden and Swiss undertakings. The cost is estimated at £360,000.—*Board of Trade Journal.*

Coventry.—At a special meeting of the Coventry City Council on the 9th inst. it was decided to introduce into a Corporation Bill now pending in Parliament, powers for supplying electrical energy to an area outside the city boundary, also to authorise the making of special charges for the supply in cases where the consumer has a separate supply of electrical energy, and to empower the Corporation to borrow further moneys for the purposes of its electric lighting undertaking. Ald. West, chairman of the Electric Light Committee, moved the adoption of the resolution, which was carried unanimously.

Dalkeith.—In connection with the arrangement for transferring certain electric lighting undertakings at Dumbarton, Melrose, Jedburgh, Dollar and Dalkeith from Messrs. Crompton and Co. to the Electric Supply Corporation, objection was taken by the Dalkeith authorities to a clause in the Bill as to supplying individual users, and a letter was read in this connection at a meeting of the Dalkeith T.C. The solicitors of the company wrote that they could not in the least agree that any clause in the proposals was ambiguous, and it was precisely the same form as a similar clause relating to various towns in England. A letter was also read from the town clerk of Montrose, saying that that town thought it was sufficiently protected. The Council agreed to let the terms of the Bill go without further opposition.

Derby.—The T.C. has decided to apply to the B. of T. for sanction to a loan of £6,350, being the estimated capital expenditure for the year ending March 31st, 1908.

Dublin.—In regard to the new turbo-generator for the Pigeon House Fort station, the engineer recommended the acceptance of the lowest tender which, in his opinion, would meet the specification, *i.e.*, Willans & Robinson turbine with Dick, Kerr alternator, at £10,043. At the quarterly meeting of the T.C., an amendment was moved that the General Electric Co.'s tender, at £8,725, be accepted. It was pointed out that that company could not comply with the clause requiring them to have carried out similar work, but, without further reference to the E.L. Committee, the amendment was carried by a large majority and confirmed by resolution.

Egremont.—The B. of T. has revoked the 1900 electric lighting order.

Hastings.—It has been agreed to construct an additional transformer sub-station at an estimated cost of £526. The cost will be partly covered by unexpended balances on other loans, and the balance paid out of revenue during the next three years.

Hoylake.—At the monthly meeting of the U.D.C. it was stated that during the past year the total receipts from all sources had been £6,763. The working expenses, with the exception of repayments, had been £2,903, the total repayment charges £3,133, making a total on the expenditure side of £6,036, which left a profit on the year's working of £727. In the year 1905 6,307,205 units were sold, and this year 353,425 units—an increase of 46,140 units, or 15 per cent. The Committee has decided to renew the battery and also to try a set of the Meldrum forced-draught apparatus in the boiler house.

Hendon.—Messrs. Crompton & Co. have given notice to the Council of their intention to lay mains in the district. It is nearly ten years since the Council obtained its order, but owing to local opposition the order was sold to the firm mentioned.

India.—MADRAS.—It is expected that the works of the Madras Electric Supply Corporation will be so far completed that a supply of electricity may be commenced in August next. All electrical energy supplied, whether for use for lighting or power purposes, will be charged at a flat rate of 4 annas per unit consumed. The rate of charge will vary from 4 annas per unit for the first 1,500 units per month down to 9 pies per unit for more than 17,000 units.—*Indian Textile Journal.*

London.—HAMPSTEAD.—At the meeting of the B.C. on the 11th inst., Mr. Dougall moved: "That the profits on electric lighting be not placed to the relief of the rates until the reserve and depreciation fund is in a more satisfactory condition." The Mayor (Councillor Hendrics) ruled the resolution out of order, and Alderman Pritchard suggested that the following resolution should be moved instead: "That the question of the amount set aside for reserve and depreciation in connection with the electric light undertaking be referred to the Finance Committee for consideration and report." This was agreed to.

HAMMERSMITH.—The Electricity Committee of the B.C. reported on Tuesday, having received a communication from the electrical engineer (Mr. G. G. Bell) dealing with the work that will be necessary in order to meet the increasing demand for electricity. After giving in detail the works for the outside distributing section which, in his opinion, would be necessary (amounting to £9,377), Mr. Bell recommended, in the first instance, the carrying out of the first section, at a cost of £2,413. The Committee agreed, and will (subject to the usual sanction) purchase the material required as soon as possible. Upon the recommendation of the Finance Committee, application is to be made to the L.C.C. for sanction to a loan of £11,145 for the electricity undertaking. Of this amount an expenditure has been already incurred of £6,985, and a further sum of £1,226 is for work which has been sanctioned by the Council and not yet commenced. The remainder is practically all for the extension of mains as set out above.

LAMBETH.—An agreement has been entered into between the B.C. and the South London Electric Supply Corporation, for the supply of electricity to the new Town Hall buildings being erected on Brixton Hill, at 3½d. net per unit for lighting supply, 1½d. net per unit for power supply (ventilator motors), while the rent for meters suitable for an installation of 700 16-c.p. lamps and for ventilator motors will be 30s. per quarter.

BERMONDSEY.—The Electricity Committee of the B.C., in a report circulated on Monday, stated that it regretted that as a result of an inquiry held by Mr. H. E. Kearley, Parliamentary Secretary to the Board of Trade, on March 12th and 18th, the B. of T. had decided not to grant the B.C. an order to supply electrical energy in the St. Olave district. The report proceeded to say that it was difficult to understand why the order was not granted, seeing that it was clearly proved that the B.C. is supplying electricity cheaper in the former parishes of Bermondsey and Rotherhithe than the London company, and had the order been granted, would have been in a position to supply in St. Olave cheaper than either company. The action brought in the King's Bench by Messrs. Leo Sunderland & Co., against the B.C., in connection with work done, has been settled by payment of £30 to the plaintiffs. The original claim was £100. The Finance Committee estimates that if the destructor was closed and all the refuse barged away, a saving of £1,984 per annum would be effected. The matter has been referred to the General Purposes Committee and the Electricity Committee for consideration and report.

GREENWICH.—The B. of T. has approved of an additional system, to be adopted, of supply of energy under the Blackheath and Greenwich Electric Lighting Orders, 1897 and 1899; Crystal Palace and District Electric Lighting Orders, 1890 and 1894; Lewisham Electric Lighting Order, 1901; and Penge Electric Lighting Order, 1901. This is to be furnished to sub-stations at a pressure of 10,000 volts, with alternating current, at 50 cycles. The extra high-pressure mains are to consist of insulated conductors enclosed in a lead sheath, and laid solid in troughs or drawn into pipes or ducts.

MARYLEBONE.—The B.C. has received a communication from the Comptroller of the L.C.C., stating that the Finance Committee will recommend the Spring Gardens authority to place the electricity loan of £1,400,000 upon a permanent basis, from December 31st last, with interest at the rate of 4 per cent. per annum. The B.C., however, is to bear the difference in the cost of interest of the Bills, now current, which were issued for the purpose of this loan at £4 6s. 6d. per cent. discount. The B.C. has agreed to this suggestion.

The Electric Supply Committee of the B.C. presented a report recently, showing that after meeting all expenses and liabilities the past year's working of the local electrical undertaking yielded a net credit balance of £29,924, as compared with an estimated balance a year ago of £23,528, after meeting financial charges.

THAMES CONSERVANCY.—At the meeting of the Conservators on Monday, the Assessor reported that the re-assessment of the suction and discharge pipes for the electricity undertaking of the Hammersmith B.C., was:—Rent, £100 per year, and fee £10 10s. It having been stated that there had been no alteration in the former rent, the report was agreed to.

HACKNEY.—The Electricity Committee has been in negotiation with the promoters of the North Metropolitan Electric Power Supply Bill, and the promoters have agreed to make such modifications in the measure as will extend to it the prohibitive clause inserted in the Act of 1905, viz.: "That the company shall not supply electricity within the Borough of Hackney for lighting purposes." The Act of 1905 authorises the company to supply electricity to any railway, tramway, canal or navigation passing through the borough. Under the circumstances the Committee has decided that on the promoters giving an undertaking to amend their Bill so that they cannot supply electricity for lighting purposes in the borough, the petition against the measure will be withdrawn.

POPLAR.—The Electricity Committee of the B.C., after considering exhaustive reports from the engineer on the matter, has decided in favour of carrying out extensions to meet next winter's demand at an estimated cost of £5,900, made up as follows:—One boiler with chimney and superheater, and including foundations, £2,550; one E.H.T. feeder with switch panels, labour, &c., £1,800; one motor-converter and L.T. panel, £1,550.

L.C.C. POWER SCHEME.—A number of the Borough Councils are supporting the following resolution which was passed by the Fulham B.C.:—"That having regard to the recent vote of the ratepayers of London, in the opinion of this Council the L.C.C. (Electric Supply) Bill should be withdrawn, and so save further expense to all the local bodies who have petitioned against it; and that a copy of this resolution be forwarded to the L.C.C., the City and Borough Councils of the metropolis, and to the Fulham representatives on the L.C.C." The matter was to be considered by the L.C.C. yesterday

Lowestoft.—The T.C. has resolved to wire houses by contract at a rental of 1s. 6d. per annum per point, and 6d. extra per lamp per annum for each lamp beyond the first on the same point; also at the option of the consumer at a price for energy and rental of wires and fittings of 1d. per unit more than the current price of energy.

Lytham.—The B. of T. has granted the U.D.C. a prov. order for E.L.

New Zealand.—WELLINGTON.—A poll of the ratepayers has been taken on the proposal of the City Council to purchase, for £160,000, the business of the supply Co. The voting was 413 for and 238 against, only 651 ratepayers voting out of 8,743 on the poll. We understand that the purchase has been completed, and the Council enters into possession on August 1st next.

Penrith.—The B. of T. has issued a prov. order authorising the transfer of the U.D.C.'s E.L. order to the Penrith Electric Supply Co.

Portsmouth.—The T.C. has applied to the L.G.B. for a loan of £15,000, for additional plant at the electricity works.

Radcliffe.—Owing to complaints about the unsteadiness of the electric light, caused by variations in pressure due to the frequent stopping and restarting of large motors in the district, the Council, on its engineer's recommendation, has authorised the installation of an automatic booster for regulating purposes. The cost will be about £360. The engineer has also been asked to prepare a scheme for extensions of plant and mains in the Council's district. The Council has agreed with Messrs. G. & S. Clegg and Co., a large firm of mill owners, to supply electricity for power purposes to their works, at 9d. per unit net, the minimum quantity to be taken per annum to be 25,000 units.

Redruth.—The U.D.C. has accepted the offer of the Urban Electric Supply Co. for public lighting for five years.

Sheffield.—The desirability of transferring entirely the generation of power from the Sheaf Street to the Neepsend station, in view of the relatively excessive cost of production at the former station, was recently mooted. It was pointed out that there was at present a very large amount of plant at Sheaf Street, which could not be economically removed, but was only used to supplement Neepsend station when the demand was heavy. The T.C. is now making provision for a large extension of the plant there established.

Sudbury.—Messrs. Hawtayne & Zeden, who have prepared plans for an E.L. scheme, have asked the T.C. if it is prepared to consider offers if anyone could be found to take up the scheme. The matter was considered on April 10th, when a desire was expressed for fuller particulars.

Whitehaven.—The T.C. has adopted new charges for energy for power purposes as under, with the view of popularising the use of motors:—For all units registered on high-rate dial from 5.30 p.m. to 11 p.m. in October and March; 5 p.m. to 11 p.m. in November and February; 4.30 p.m. to 11 p.m. in December and January; and from 4 p.m. to 11 p.m. in Christmas week, 4½d. per unit. On the low-rate dial, 1½d. per unit up to 1,500 units per quarter; 1¼d. above 1,500 and under 2,500; 1½d. above 2,500 and under 5,000; 1d. beyond, with a minimum quarterly payment of 13s. 4d., and 5s. per quarter, meter and time-switch rent.

Wimbledon.—The T.C., at its meeting on April 3rd, authorised the engineer to negotiate for permission to construct a weir across the River Wandle below the Council's present condensing water intake, in order to ensure a constant supply of condensing water. The Council decided to place 18 "flame" arc lamps in Worple and Kingston Roads, and 15 in Haydons Road, 150 yds. apart, at an estimated cost of £675. The sanction of the L.G.B. was received to the borrowing by the Council of £15,060 for mains, repayable in 18 years, £2,810 for transformers, repayable in 20 years, and £2,780 for meters, repayable in five years. The

borough treasurer reported that the assessment of the electric lighting undertaking had been increased by the overseers from £1,700 to £3,000. The L.G.B. has objected to further capital expenditure on public lighting, suggesting that the expenditure should be defrayed out of revenue; it has also objected to the type of lamp proposed as being experimental, although it has previously sanctioned expenditure on similar lamps.

Worthing.—A L.G.B. inquiry was held on April 10th into the application of the T.C. for a loan of £2,133 for E.L. purposes, viz., £473 for suction gas plant; £160 for water-softening plant; £500 for extension of distributing mains; and £1,000 for meters and house services. Mr. G. Porter, electrical engineer, said it was anticipated that a saving would be effected on the running cost by the provision of the gas plant. Mr. F. Kelly opposed on behalf of the Broadwater Ratepayers' Association, because a portion of the borough was not lighted by electricity.

TRAMWAY and RAILWAY NOTES.

Accrington.—Mr. T. L. Miller, consulting engineer, has been retained by the T.C. to advise it as to the purchase of the tramway rolling stock in connection with the electrified tramways.

Belfast.—At the meeting of the Tramways and Electrical Committee on the 15th inst., Sir Robert Anderson presiding, it was announced in the manager's report that the working profit on the undertaking for the financial year was £77,881, which after deducting interest, &c., left the equivalent of 11 per cent. on the capital expenditure of £1,060,000. The manager (Mr. Nance) expressed his regret at the departure of Mr. V. A. H. M'Cowen for Salford, and his confidence in Mr. Bloxam, his successor.

The passengers carried during the 12 months ending March, 1907, numbered 42,945,849, an increase of 12,800,000. The car-mileage showed an increase over the previous year, of 1,671,709, and the receipts an increase of £44,652, or 33½ per cent.

Cardiff.—The manager of the tramways, Mr. Arthur Ellis, is to be given a free hand in the management and running of the Corporation tramway service during the coming year, with a view to improving the returns. The fares, however, will still be controlled by the Committee.

Continental Notes.—HOLLAND.—The construction of new tramways is announced as follows:—(1) Between Arnheim and Nynewgen, 35 miles. The gauge will be 1·067 m., and the cost is estimated at about £120,000. (2) Between Breskens and Terneuzen, 20 miles. (3) Ennuen to Ter Apil (the latter is at present a scheme only).

SPAIN.—A company has just been formed in Valencia, with a capital of £20,000, with the title La Sociedad Valenciana de Locomocion y Energia to construct and work an electric tramway between that town and Moncada.

ITALY.—The "Società di navigazione e ferrovie per il lago di Lugano," has been authorised to construct and work an electric funicular railway between Santa Margherita and Belvedere di Lanzo d'Intelvi.—*Board of Trade Journal.*

Croydon.—An inquest was held on the 12th inst. on the body of Mrs. Suhr, the first person to succumb to injuries received in the recent tramway accident. The driver's evidence showed that although he had only been employed by the South Metropolitan Tramway Co. for a short time, he had had considerable experience on the Croydon tramways in a similar capacity. He did not consider that the car attained any excessive speed, but that it was well in hand just prior to the accident. Questioned as to why he did not stop at the corner where the car overturned, he said: "I had been feeling my brakes all along. About 80 yds. from the spot I tightened up my hand-brake to stop the car at the corner. I felt my wheels skid a bit, and at once applied sand, at the same time using my brakes. The wheels then began to revolve. The car then began to get down into a gradually reduced speed. This was just before I got to the corner. The wheels then began to skid again, and I was still using my hand-brake. At the same time I had my power, or emergency, brake on. At times I eased the hand-brake off." He could not explain the skidding of the car, which apparently led to the accident. There was no radical defect in the mechanism of the car which would account for failure; the car had recently been overhauled. Other evidence showed that the rails had just previously been watered; the gradients leading to the corner were from 1 in 15 to 1 in 23, and as low as 1 in 37 at the corner. The conductor of the car admitted having applied the rear brake some 100 yds. or so before reaching the fatal corner, although he had not received the usual signal from the driver. The company's engineer and its manager expressed the opinion that the driver had taken all ordinary precautions. The jury, in its verdict, said that the accident was caused by taking the curve at too high a speed, and the brakes not acting properly; it further expressed the opinion that the driver's experience of the route was insufficient, and that he ought not to have been sent out by the company. The Coroner, Dr. Jackson, emphatically dissented from the latter portion of the verdict.

Heywood.—At the meeting of T.C. on Friday, it was stated that the tramways undertaking of the Corporation for the past year showed a profit of £154. It was contended that better terms with both Bury and Rochdale could be obtained, and that the Corporation ought to have something like £1,000 a year profit from the tramways. There are now 4 miles under construction, the contractors for the overhead equipment being R. W. Blackwell & Co.; and feeders, the British Insulated and Helsby Cables. Mr. J. Stott is the electrical engineer.

Liverpool.—On the 13th inst. a tramcar, after descending from Everton Valley, jumped the metals at the bottom of a hill, breaking through a row of iron protection posts and a brick wall. The car was much damaged, and several passengers injured. An almost identical accident occurred at the same place three years ago.

London.—On Friday evening last an unfortunate accident occurred at the Holborn Station of the Great Northern and Piccadilly Railway. A station foreman, for some reason unexplained, opened the upper door of a lift shaft, and fell through on to an ascending lift, crushing through the roof and injuring three of the passengers. The foreman was dead when picked up.

Manchester.—Two short lengths of tramway, in Gorton, were opened by the Lord Mayor of Manchester last Friday. These, with a short length in Reddish Lane, off Hyde Road, will enable the service of cars to Reddish, by a new route, to reach a point only 100 yards from the Stockport terminus. It is hoped that some time hence an arrangement will be made which will admit of the Manchester and Stockport systems, *via* Reddish, being linked up. The Manchester Corporation has a lease of the Gorton lines for 21 years, paying a rent which will cover the initial cost of construction and equipment. On the expiration of the lease the lines will become the property of the Gorton Urban Council. The new Reddish line will tap a population of about 50,000, mostly of the working class. It is desired to make a branch to Abbey Hey, where there is a rapidly growing population. The obstacles in that direction are narrow roads and a railway bridge. The latter will have to be reconstructed.

Mansfield.—The B. of T. has recently confirmed the Mansfield and District Light Railways (Extensions) Order, 1907.

Merthyr Tydfil.—The Local Traction and Lighting Co. has applied to the B. of T. for an extension of time until May 16th, 1909, for completing the works authorised by the Merthyr Tydfil Light Railway Order, 1899.

Newcastle-on-Tyne.—At a meeting of the T.C. on the 10th inst., Alderman Sir Joseph Ellis moved the sealing of an agreement between the Corporation and the Board of Guardians with regard to the assessment of the tramway undertaking. The Tramways Committee, he said, had objected to the new assessment, and it had come to an arrangement whereby the figure remained as before, which meant a reduction of nearly £13,000. All the costs in connection with the appeal, so far as it went, were to be paid by the Guardians, with the exception of £25. It had further been agreed that in the future, an arbitrator on behalf of the Corporation and an arbitrator on behalf of the Guardians would settle the assessment of the tramway undertaking. The agreement was sealed. At the same meeting it was reported that the receipts last year amounted to £210,490, against £197,173 in the previous year, an increase of £13,317. This was independent of the amount to be received from the Watch Committee for the supply of electricity for street lighting.

Newcastle-Under-Lyme.—The B. of T. has granted an extension of three years for the construction of the electric tramways between Trent Vale and Newcastle, by the Potteries Electric Traction Co.

New Zealand.—AUCKLAND.—The Tramway Co. has recently paid a fine of £320 to the City Council for shortage of rolling stock. The company has now 60 cars, and others are being completed. The question of giving a temporary supply for lighting and power from the Tramway Co.'s power station to certain private consumers is being considered, pending the opening of the Council's own supply.

Pontypridd.—At a meeting of the Tramways Committee last week, the resident engineer suggested that a better return could be obtained if the cars could be run through to Porth, over a section of the Rhondda Valleys Tramways Co.'s lines, and that overtures should be opened with this end in view. It was resolved to defer the matter until the completion of the Council's tramways.

South Africa.—DURBAN.—The tramway manager's report on the municipal tramways for the month of February, states that the receipts amounted to £6,336 17s., being £439 below the corresponding period of last year. Car-miles = 90,102; revenue per mile run, 16·35d.

PORT ELIZABETH.—At a meeting of the Port Elizabeth ratepayers held on March 19th, the T.C. was authorised to borrow a further sum of £25,000 to complete the installation of the electric lighting scheme. The original estimate was £83,358, and the amount expended to date is £110,467, the original loan being £100,000.

Swinton and Pendlebury.—In a report to the Urban Council on the year's work, the Tramways and Electricity Committee states that the South Lancashire Tramways Co. have completed the lines between Pendlebury and Winton. Some litigation in connection with the lines of the Salford Corporation has been closed, and the purchase of the undertaking completed. The agreement between the Corporation and the Council regarding the working is still open. The depôt in Church Street, Pendleton, has been conveyed to the Corporation, in consideration of the lease taking effect as from January 1st.

Tramway Authorities and Post Office Proposals.—Representatives of fifty municipal tramway authorities, including the L.C.C. and the Corporations of Glasgow, Manchester, Sheffield, Birmingham, and Leeds, met at the Westminster Palace Hotel on the 12th inst. to consider the proposed introduction in the L.C.C., Manchester, Glasgow, and Sheffield Tramways Bills in the present Session, of provisions under which the Post Office may use the posts, standards, and brackets of these tramway authorities as supports for telegraph and telephone wires. Alderman Wainwright (Manchester) presided, and it was agreed to ask the Postmaster-General to receive a deputation on the subject, and to request the promoters of the Bills named strenuously to oppose the introduction of the proposed new clauses.

Tynemouth.—Dissatisfaction is being expressed by those connected with the Tynemouth Tramways Co., that better terms for the supply of energy are being accorded to another tramway company which runs into the borough. It is contended that preferential terms cannot in this case be legally given.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telegraphs.—Negotiations are on foot for the reduction of the rates between England and France. It is proposed also to increase the number of telephone lines between London and Paris.

Cape Colony.—Oudtshoora.—At the Farmers' Congress for the Eastern Province of South Africa, held at Oudtshoora, a new subject, indicative of the spirit of progress amongst the farmers, was introduced by a member asking that permission be obtained from the Colonial Government for farmers to run telephone wires along existing fences at their own expense, such wires to be connected with the Post Office free of charge. One member said he had had satisfactory experience of such telephones in Australia. The motion was carried, with an amendment allowing the Government to make a moderate charge for connection with their offices.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902 ..	..
Curacao-Coro Curacao-La Guayra } Closed.. Curacao-Maracaibo	.. .. .. Jan. 12, 1906 ..	..
Reissa-Issa and Reissa-Yemani (Yemen) ..	.. Oct. 22, 1902 ..	..
Tarifa-Tangier	.. Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)	.. Mar. 9, 1904 ..	..
Garachico-Santa Cruz	.. July 12, 1906 ..	..
Las Palmas-Arecife	.. Aug. 18, 1906 ..	..
New Brunswick-Prince Edward Island ..	.. Jan. 9, 1907 ..	..
Tenedos-Chio	.. Feb. 13, 1907 ..	..
Landlines.		
Puerto-Barrios	.. Aug. 28, 1902 ..	..
Cadiz-Teneriffe	.. April 10, 1907 ..	..

Radiotelegraphic Convention.—On Tuesday Sir J. Dickson Poynder's Committee resumed the consideration of the Convention, and Mr. Cuthbert Hall, managing director of the Marconi Companies, gave evidence. The report will appear in our next issue.

CONTRACTORS' COLUMN.

Openings for New Business.

ACCRINGTON.—Congregational school. Messrs. Haywood & Harrison, Accrington.

BOLTON.—Mill extension (plans just passed). Manager, Bolton Heald Co., Bolton.

New hotels and public-houses. Messrs. W. Tong & Sons, brewers, Bolton, intend rebuilding two or more of their public-houses.

BRIGHTON.—Library. E.L. installation to be altered. Chief librarian, Public Library, Church Street, Brighton.

BIRMINGHAM (Nuhills).—Baths to be erected by the T.C.

BRADFORD.—Tube works. Parkinson, architect, Queensgate Chambers, Bradford.

Warehouse. B. Dobson, architect, Charles Street, Bradford.

(Thornbury).—Works for Shackleton's Tube Co., Ltd. Mr. Parkinson, architect, Queensgate Chambers, Bradford.

BOURNEMOUTH.—New church for St. Augustine's Parish (£10,500). Rev. S. C. Lowry, M.A., vicar.

BURSLEM (Staffs.)—Public mortuary. Borough surveyor, Queen Street, Burslem.

CAERPHILLY.—New station for Great Western Railway.

CASTLETOWN (Berehaven, Co. Cork).—New church (£8,000). Messrs. Doolin, Butler & Donnelly, Dublin.

CHATHAM.—Central Hall (£17,000).

CHELMSFORD.—Literary and Mechanics' Institute.

Out-patient department, Coventry and Warwickshire Hospital. H. W. Chattaway, architect, Trinity Churchyard, Coventry.

CLECKHEATON (Hightown).—United Methodist church and schools (£1,600). H. Harper, architect, Nottingham.

CHESTERFIELD.—Extension to Chesterfield and North Derbyshire Hospital (£15,000).

COVENTRY.—New senior elementary schools, Broad Street. J. E. Swindlehurst, city engineer, Coventry.

CUMBERLAND.—Alterations and additions to Dearham Council School. J. Forster, clerk of works.

DUBLIN (Amiens Street).—Extension of general offices for Great Northern Railway Co. (Ireland). T. Morrison, Secretary.

(Portadown Station).—Extension of post office rooms for Great Northern Railway (Ireland). T. Morrison, secretary.

DUNDEE (Dura Street).—Restoration of works for Malcolm, Ogilvie & Co., Ltd.

(Mary Ann Lane).—Restoration of warehouse for G. Wilsher and Son.

(Victoria Road).—Alterations to theatre for New Gaiety Theatre Co.

EDMONTON.—Church Institute to be erected as a Memorial to Chas. Lamb (£4,700).

EDINBURGH.—Additions to Heriot-Watt College.

FARNWORTH (Bolton).—New public school (£7,000). W. Johnson & Sons, Ltd., contractors, Bolton.

FOLKESTONE (Cooling's Lane).—New school. Chas. Jenner, builder, Folkestone.

GLASGOW (Bridgeton).—Additions to Barrowfield Bleaching Works.

HARROGATE (Nidd).—Home for Girls in connection with Church of England Waifs and Strays Society.

HEBDEN BRIDGE.—Mission church. Sutcliffe & Sutcliffe, architects, Halifax.

HEREFORD.—Cabinet-making factory, for Greenlands, Ltd. Groome and Bettington, architects, Palace Chambers, King Street, Hereford.

HULL.—Printing works for A. Brown & Sons, Ltd. Harbron & Robson, architects, 50, Spring Bank, Hull.

ILFORD (Seven Kings).—Public library lecture hall to be built by U.D.C. (£3,700).

KIDDERMINSTER.—Motor works. T. Vale & Sons, builders, Kidderminster.

KIRKBY.—Rebuilding of church (£7,000).

LANCASTER.—New Villa for Private Patients at Lancaster County Lunatic Asylum. Mr. H. Aspinall, Prudential Buildings, Dale Street, Liverpool.

LEEDS.—Clothing factory for J. Hepworth & Son, Ltd. W. S. Braithwaite, architect, 6, South Parade, Leeds.

House and shop premises (Mabgate). Thos. Winn & Sons, architects, 84, Albion Street, Leeds.

LEEK (Staffs.).—Extension to Isolation Hospital (£1,806). Thos. Grace, builder, Leek.

LIVERPOOL (Egremont).—New Presbyterian Church, Seabank Road. Briggs, Wostenholme & Thornely, architects, Liverpool.

(Walton).—Public baths. W. R. Court, engineer and chief superintendent, Municipal Offices, Liverpool.

LIVERPOOL.—New theatre plans passed by City Council (£20,000). Wm. Henry Broadhead, Manchester, owner.

LONDON (Westminster).—Warehouse buildings on site of 41 and 42, Floral Street. Howard & Co., 3, Broad Court Chambers, Long Acre, W.C., builders.

(Hammersmith).—Buildings in Uxbridge Road. J. H. Richardson, 22, King Street, Hammersmith, architect.

(Hammersmith).—Buildings. W. G. Ingram, 4, Verulam Buildings, Gray's Inn, W.C., architect.

(E.C.).—Rebuilding 9, New Bridge Street. N. Fortescue & Sons. 215, Mare Street, Hackney, contractors.

(Hackney).—Three-storey building. Hodson & Whitehead, 7, Finsbury Square, E.C., architects.

(Hackney).—Additions to R.C. schools, Wick Road and Ballance Road.

(Rotherhithe).—Schools for trustees of Christ Church Schools, Christ Church, Rotherhithe, S.E.

(Rotherhithe).—Addititions to works of H. J. Enthoven & Sons, Ltd., Rotherhithe Street, S.E.

(Hampstead).—University College Schools. Dove Bros., Studd Street, Islington, builders.

(Hampstead).—Block of five studios. W. Richardson, 493, Fulham Road, S.W., builder.

(Marylebone).—New Town Hall.

Admiralty extension. Block IV. Sir Aston Webb, architect, 19, Queen Anne's Gate, S.W.

LOWESTOFT (Oulton Broad).—New public school (£2,349). A. Beckett, Oulton Broad, builder.

MACCLESFIELD.—New public secondary school (£11,690). John Clayton, contractor, Sunderland Street, Macclesfield.

MAIDSTONE.—New theatre and anæsthetic room at West Kent Hospital.

MERTHYR TYDFIL.—Public library at Treharris. Mr. Dowdeswell, architect, Treharris.

(Uphall).—Public school. H. and D. Harris, builders, Marlow.

MANCHESTER (Walkden).—Plans have just been passed for Lord Ellesmere for enlargement of model creamery at Walkden. Write Capt. H. V. Hart-Davis, Bridgewater Offices, Walkden.

(Walkden).—Two large shops. Write to Mr. W. Hall, manager, Co-operative Stores, Walkden.

MIDDLESBROUGH (Linthorpe).—Wesleyan Church Schools, &c. A. Forrester, architect, 20, Albert Road, Middlesbrough.

NORWICH.—Unitarian Church, Schools, &c. (£7,000). H. Chatfield Clarke, architect, 6, Kensington Gardens Square, London.

NEWCASTLE.—New County Offices, Castle Square. Elliott Bros., Otterburn Terrace, Newcastle-on-Tyne, builders.

Public Branch Library, Benwell Lane. Wm. Hall, Gateshead, builder, Derwent Works, Bensham.

NAIRN.—New school (cost £6,000).

NEW INN (near Pontypridd).—New school for Monmouthshire Education Committee. H. J. Griggs, architect.

NOTTINGHAM.—New Albert Hall.

ORPINGTON (Kent).—New fire station.

PORT TALBOT.—New Baptist chapel at Cymmer. Evans & Jones, architects and surveyors, 4, Trinity Place, Swansea.

PLYMOUTH.—Primitive Methodist Church and Schools. R. Lethbridge and Son, Plymouth, contractors,

SUNDERLAND.—Two Branch Libraries, to be erected by the T.C.

SUTTON-IN-ASHFIELD (Notts).—New public school to accommodate 400 to be built, and Mansfield Road Schools to be enlarged.

ST. HELEN'S (Newtown).—New Congregational church (£4,500).

SWANSEA (Caswell).—Home of rest for the blind. Henry Billings, contractor, Swansea; G. Moxham, architect, Swansea.

New County Court and Official Receiver's Offices to be built.

TYLDESLEY (Lancs.).—New collieries about to be sunk. Write Managing Director, Astley and Tyldesley Coal Co., Tyldesley, near Manchester.

UCKFIELD.—Alterations and additions to Public Hall. Messrs. Overton and Scott, architects and surveyors, Public Hall, Uckfield.

WEST HAM.—Extension to West Ham Hospital (£18,518). Foster & Dicksee, Manresa Road, Chelsea, builders.

WISBECH (Walsoken).—Extensions to public schools. T. W. Kerridge, architect, Club Chambers, Old Market, Wisbech.

CONTRACTS OPEN and CLOSED.

OPEN.

Belgium.—April 20th. The municipal authorities of Brussels are inviting tenders for the supply and erection at the central electricity works of a turbo-alternator of 5,000 KW. capacity. Particulars can be obtained from the Service, 11, Rue Sainte Catherine, Brussels, and tenders are to be sent to Le Collège des Bourgmestre et Echevins, Hotel de Ville, Brussels.

Belgium.—April 23rd. Tenders are required for (1) electric lighting of forts, (2) searchlight embrasures, by the Commandant du Génie at Liége-Rive gauche, Rue Lairesse, 33.

Belgium.—May 4th. The municipal authorities of Tongres are inviting tenders for the establishment of a central electric lighting station in the town. Particulars may be obtained for 10 francs from, and tenders are to be sent to, Le Collège Echevinal, Hotel de Ville, Tongres.

Belgium.—May 6th. The Provincial Government at Liége requires tenders for the construction, maintenance, and exploitation of an electric tramway from the railway station at Spa to the Hippodrome, which is to be built at La Longue Reid, and the construction of a branch line to the Forester's house at Theus. A deposit of £800 is required. Registered tenders must be sent in by May 2nd.

Cardiff.—April 19th. Advertising rights on the Corporation tramcars. See "Official Notices" April 5th.

Cardiff.—April 26th. Extra-high-tension three-phase feeder cable and switchboard for the Corporation. See "Official Notices" to-day.

France.—April 26th. The French Post and Telegraph authorities in Paris are inviting tenders for the supply of 50 tons of bi-metallic wire 3 mm. diameter. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris.

Gillingham.—April 22nd. Meters and demand indicators for the Electricity Committee. See "Official Notices," April 12th.

Glasgow.—April 22nd. Cast-iron joint-boxes for the Corporation electricity department.

Glasgow.—April 22nd. Cables, wires, meters and carbons for the electricity department. See "Official Notices" April 12th.

Handsworth.—April 24th. Extension pipe-work for the U.D.C. electricity works. See "Official Notices" March 29th.

Harrogate.—April 30th. Electric light wiring and fittings for the Grove Road council school. Specifications from the Electricity Department, 33, Swan Road.

Hull.—April 23rd. Mains for the electricity department. See "Official Notices" April 12th.

Islington.—May 8th. Electrically-driven fan for the Lighting Committee. See "Official Notices" April 12th.

Kirkcaldy.—May 4th. Boiler feed pump (3,000 gals. per hour) for the Corporation Electricity Works. See "Official Notices" to-day.

L.C.C.—April 30th. Nine electrically-driven ventilating fans at the Central School of Arts and Crafts and the London Day Training College, Southampton Row, London. See "Official Notices" to-day.

Luton.—April 19th. Engine-room and boiler-house plant for the T.C. electricity works. See "Official Notices" April 5th; also an amended notice in April 12th issue.

Malvern.—April 29th. Various materials for the U.D.C. Electricity Department. See "Official Notices" to-day.

Malines.—May 6th. Tenders are required for an installation to repair and charge electric accumulators. The estimate is £412, and a deposit of £136 is required. Particulars, Specification No. 64, 1907, may be obtained for 4d. from Mr. Slaghmuylder, 1, Rue de Brabant, Brussels.

Melbourne (Victoria).—May 7th. Tenders will be received at the office of the Deputy Postmaster-General, Melbourne, for the supply and delivery at Melbourne of two telephone switchboards. See this column in our April 5th issue.

Paris.—April 27th. The Under-Secretary for Posts and Telegraphs requires tenders for 550,000 porcelain insulators, in 11 lots. Particulars may be obtained from the Administration, 103, Rue de Grenelle, Paris.

Pembroke.—May 4th. High speed engine, D.C. dynamo, switchboard and instruments, accumulators, boiler, arc lamp and gear, arc lamp-posts for the U.D.C. See "Official Notices" to-day.

Portsmouth.—April 26th. Electrical wiring and fitting for the Municipal Institute and Free Library. See "Official Notices" April 5th.

Shanghai.—May 4th. One 800-KW. horizontal steam turbo-alternator (single-phase), with condensing plant, for the Municipal Council. See "Official Notices" April 12th.

South Australia.—June 12th. The Postmaster-General requires tenders for 500 Meidinger line cells; 500 Meidinger line cups; 5,000 Meidinger line corks and tubes; 6,000 Meidinger line zincs; 6 tons of sulphate of magnesia; and 7 tons of crushed sal-ammoniac.

Southport.—May 2nd. Advertising on Corporation tramcars. See "Official Notices" to-day.

Spain.—May 26th. The Public Works Department will receive applications for two concessions as follows:—(1) Construction of electric tramways in Barcelona; extension of line from Josepets to Bonanova. (2) Construction of electric tramway from Marsala to Marbella.

Spain.—April 26th. The municipal authorities of Osorno (province of Palencia) are inviting tenders for the concession for the electric lighting of the town during a period of twenty years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Osorno (Palencia).

Warrington.—April 23rd. Water-tube boilers, economiser, coal conveyor, induced draught plant, and three-wire balancer for the Corporation. See "Official Notices" April 12th.

Woolwich.—May 1st. Additions to the electric lighting installation at the Plumstead infirmary for the Woolwich guardians. Specifications (two guineas) from the Clerk to the Guardians.

Wolverhampton.—May 2nd. Boilers, economiser, feed pumps, steel chimney and feed-water tank; also turbo-alternator generating sets and condensing plant for the Electricity Committee. See "Official Notices" to-day.

CLOSED.

Acton.—The following tenders were accepted on Monday by the Electricity Committee of the U.D.C.:—Motor, B.T.-H. Co., Ltd., at £53; machine tools, at £131, Selig, Sonnenthal & Co. The electrical engineer was instructed to order certain cable from the St. Helen's Cable Co., Ltd., and a number of meters from Messrs. Chamberlain & Hookham.

Ashton-under-Lyne.—The T.C. has accepted the tender of the British Thomson-Houston Co. for a year's supply of motors.

The contract for a year's supply of motor starting switches to the corporation has been awarded to the Adams Manufacuring Co., Ltd., for their "Igranic" rheostats.

Aston Manor.—The Corporation has accepted the tender of Messrs. Johnson & Phillips, Ltd., for extensions to switchboard.

Auckland (N.Z.).—The City Council received seven tenders for the complete plant for the electric lighting of the city. These were tabulated and analysed by the city engineer (Mr. F. Bush) and the consulting engineer (Mr. W. E. T. Goodman). The Committee recommended the acceptance of the lowest tender (that of the Australian General Electric Co.). Messrs. Turnbull and James's was the next lowest. Mr. Goodman said that the cost should not exceed his original estimate by more than £1 000, and that difference was due to recent rapid increase in cost of copper and other materials. The following tenders were submitted:—

Siemens Bros.' Dynamo Works, Ltd. (Sydney) ..	£14,799	J. J. Craig, Ltd.	£16,811
Dick, Kerr & Co.	15,010	A. T. Burt, Ltd.	14,067
Turnbull & James, Ltd. ..	14,469	Stewart & Fenn	14,882

The Australian General Electric Co. submitted a number of alternative tenders from both their Sydney and Wellington branches. The Sydney branch quoted:—£13,220, £13,137, £12,839, £12,278, £13,007, £13,027, £12,782; the Wellington branch, £14,163, £14,298, £14,436, £14,403, £13,349, £13,441, £13,615 and £13,585.

Cardiff.—The T.C. has accepted the tender of Messrs. Bruce Peebles & Co. for the supply of a motor-generator for the new docks sub-station, at £1,030.

Dublin.—The Corporation has not accepted the recommendation of the Lighting Committee for the acceptance of Messrs. Willans & Robinson's tender for the turbo-generating plant, with Dick, Kerr alternator, at £10,043. An amendment, "That the contract be given to the General Electric Company at £8,725," was carried by 39 votes to 10.

Germany.—The Prussian State Railway authorities in Kattowitz have just placed a contract with Messrs. Felten and Guilleaume, of Mulheim, for 21 KM. of telegraph cable, single wire, and 7·3 KM. ditto with 3 wires.

Glasgow.—New switchboard for St. Andrew's Cross station, Messrs. Mechan & Sons, Ltd., £597.

Glenboig.—The following is the result of the tenders received by Messrs. Stevenson, McGuffie & Milne, consulting engineers, Glasgow, for Messrs. Wm. Baird & Co.'s Bedlay Colliery, at Glenboig. Complete electric generating plant, Messrs. Mavor and Coulson, Ltd., £4,724, with the following sub-contractors:—

Engines.—Bellis & Morcom, Ltd.
Switchboard.—British Thomson-Houston Co.
Condensers, valves, &c.—Körting Bros., Ltd.
Cooling tower.—Midland Engineering Co.
Pumps.—Mather & Platt, Ltd.
Cables.—Callender's Cable Co.

Hammersmith.—The B.C. has received the following tenders for the erection of a steel shaft, 100 ft. high, for the electricity works, to remedy, as far as possible, the causes of complaints from time to time received of the alleged nuisance and annoyance from the emissions of smoke, fumes and grit:—

Fulham Steel Works Co. (accepted)	£400	Westwood & Wrights	£667
Thames Ironworks Co. ..	455	Fraser & Son	570
Cross & Cross	479	Nichols & Reynolds	650
Mechan & Sons	525	Thornycroft & Co.	791
		Cadogan Ironworks Co. ..	935

Handsworth.—The U.D.C. has placed an order for the supply of cable with Messrs. Johnson & Phillips, Ltd.

Johannesburg (S.A.).—The T.C. has accepted the tender of Messrs. Brook & Co. for the supply of 1,800 consumer's service cable boxes, at £1,695.

Poplar.—The Lighting Committee has received the following tenders for the supply of cable:—

Siemens Bros. & Co.	£1,335 10s.
Western Electric Co. (recommended)	£1,300
Henley's Telegraph Works Co.	£1,340
British Insulated and Helsby Cables	£1,3[illegible]6
W. T. Glover & Co.	£1,320
Callender's Cable Co.	£1,355

For the supply and erection of a boiler for the generating station, with chimney and superheater, the following tenders were received:—

Clark, Chapman & Co. (recommended)—(1) price, £2,100; (2) heating surface, 4,150 sq. ft.; (3) grate area, 88 sq. ft.
Stirling Boiler Co.—(1) £2,800; (2) 4,096 sq. ft.; (3) 88 sq. ft.; (4) superheater heating surface, 550 sq. ft.
Babcock & Wilcox—(1) £3,050; (2) 4,000 sq. ft.; (3) 98 sq. ft.; (4) 670 sq. ft.

Southport.—The T.C. has accepted the tender of the Staveley Coal and Iron Co. for the supply of cast iron troughs and pipes for the electricity works.

Stockport.—The B.G. has accepted the tender of Messrs. Fildes & Barlow, Stockport, for installing the electric light at the new offices, at £121.

FORTHCOMING EVENTS.

To-day's Events (Friday, April 19th).—At 8 p.m. Electro-Harmonic Society. Last Smoking Concert of the Season, at Holborn Restaurant.

At 7.30 p.m. N.E. Coast Institution of Engineers and Shipbuilders. Meeting in the Lecture Theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-upon-Tyne. Discussion to be resumed on Mr. W. C. Mountain's paper on "The Applications of Electricity to the Driving of Pumping Machinery for Pontoons and Graving Docks." Discussion on paper on "Marine Steam Turbine Development," by Hon. C. A. Parsons and Mr. R. J. Walker.

Saturday, April 20th.—Royal Institution. Prof. Silvanus P. Thompson, F.R.S., on "Studies in Magnetism." (Tyndall Lecture II.)

Wednesday, April 24th.—At 8 p.m. Society of Arts. "Rubber Cultivation in Government Experimental Station, Ceylon.

Thursday, April 25th.—At 7.15 p.m. Institution of Electrical Engineers (Leeds the British Empire," by Mr. Herbert Wright, Controller of the Local Section). At the University. Annual general meeting. Continuation of discussion on Mr. W. M. Rogerson's paper on "Underground Mains."

Institution of Electrical Engineers. Ordinary general meeting at the Institution of Civil Engineers, Gt. George Street, S.W. If discussion on Prof. Schwartz's paper concluded on April 18th, the following paper will be read and discussed: "Depreciation Provision on Electricity Supply Undertakings," by Mr. R. Hammond.

Friday, April 26th.—At 9 p.m. Royal Institution of Great Britain, Albemarle Street, Piccadilly, W. Discourse by Mr. James Swinburne, F.R.S., on "New Illuminants."

Saturday, April 27th.—At 3 p.m. Royal Institution of Great Britain. Prof. S. P. Thompson, F.R.S., on "Studies in Magnetism." (Tyndall Lecture III.)

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, April 22nd.—"A" Company, infantry drill (practice for competition), 7 p.m.
Tuesday, April 23rd.—"B" Company, infantry drill (practice for competition), 8 p.m.
Thursday, April 25th.—"C" Company, infantry drill (practice for competition), 7 p.m.
Friday, April 26th.—"D" Company, infantry drill (practice for competition), 7 p.m.

J. H. S. Phillips, Captain, for Adjutant on leave,
Electrical Engineers R.E. (V.).

NOTES.

Electrolysis in U.S.A.—The *Western Electrician* of March 23rd draws attention to a report by Mr. Knudson on the electrical conditions prevailing in Providence. From what we read it is evident that the track returns of that class of "city" are in no wise as good as the tracks on the Continent of Europe. In order to cut down the difference of potential between water meters and earth the meters were insulated by china plates. A suggestion that damage to underground pipes and cable sheaths might be lessened by bonding the large water mains to the return, was not put into practice after a test on an 8-in. main showed an increase in the stray current from 4·5 amperes under the usual conditions, to 150 amperes when the pipe was connected to the return. The subject has been investigated so extensively in America, to say nothing of the careful researches made in Europe, that we do not think much new light can be thrown upon it by further tests of this class.

Birmingham Football.—On Saturday, 6th inst., a football match took place between teams representing the Birmingham and Midland Tramways Smethwick Power Station and the Summer Lane Power Station of the Birmingham Corporation. The Smethwick Power Station team were the victors by 12 goals to 2.

Clydebank Docks Electrical Machinery.—The Prince and Princess of Wales on Wednesday next are to set in motion the electrical machinery with which the new docks at Clydebank, belonging to the Clyde Navigation Trustees, are fitted.

Electric Supply Football.—It has been suggested by representatives of various electric supply undertakings of London, that an Association Football League should be formed and run on similar lines to the Cricket League. A meeting to consider the suggestion is to be held at the offices of the St. James' Company at Carnaby Street on May 2nd, 1907, at 6.30 p.m., when all interested are invited to attend. Will those who intend to be present kindly inform any of the undersigned seven days previous to the meeting:—

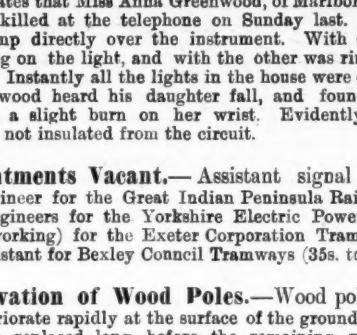
A. W. Seabright, Chelsea Electricity Supply Co., 19, Cadogan Gardens, S.W.
H. Horobin, St. Pancras Boro' Council, Electricity Department, 57, Pratt Street, Camden Town, N.W.
T. C. Brice, St. James' and Pall Mall Electric Light Co., Ltd., Carnaby Street, Golden Square, W.

Electro-Harmonic Concert.—Major W. A. J. O'Meara, C.M.G., Engineer-in-Chief to the General Post Office, has consented to occupy the chair at to-night's smoking concert—the last of the season—the arrangements for which we referred to in our last issue.

Fatality.—The *Daily Telegraph's* New York correspondent states that Miss Anna Greenwood, of Marlboro', Massachusetts, was killed at the telephone on Sunday last. There is an electric lamp directly over the instrument. With one hand she was turning on the light, and with the other was ringing for the exchange. Instantly all the lights in the house were extinguished. Mr. Greenwood heard his daughter fall, and found her dead. There was a slight burn on her wrist. Evidently the switch handle was not insulated from the circuit.

Appointments Vacant.—Assistant signal and interlocking engineer for the Great Indian Peninsula Railway; junior assistant engineers for the Yorkshire Electric Power Co.; depôt foreman (working) for the Exeter Corporation Tramways (45s.); general assistant for Bexley Council Tramways (35s. to 45s.).

Preservation of Wood Poles.—Wood poles are very apt to deteriorate rapidly at the surface of the ground, so that they have to be replaced long before the remaining parts become unsound. To remedy this trouble M. E. Löwit has devised the simple and very successful guard shown in the accompanying



Preservation of Wood Poles.

figure, which consists of two concrete blocks placed round the base of the pole from a depth of 1 ft. below the ground level, the space between the pole and the blocks being afterwards filled up with cement, the upper surface of which is shaped to deflect water from the pole. These guards can be applied to poles already in place.—*Génie Civil.*

Institution and Lecture Notes.—Institution of Electrical Engineers (Manchester Section).—The annual meeting of the Section was held on the 9th inst. Mr. S. L. Pearce proposed a hearty vote of thanks to the chairman (Mr. T. L. Miller) for his services during the past year, which Mr. Frith seconded, and Mr. Miller briefly acknowledged the compliment. Votes of thanks were awarded, to the hon. secretary, Mr. Wilson, who thanked the members, and referred in warm terms to the way in which he had been assisted by Mr. Green, the assistant secretary; and to the Council of the University and Dr. Schuster for their kindness in allowing the use of the room for holding the meetings. The secretary read the annual report, which stated that the membership stood at 732, compared with 769 last year. The Students' Section had held eight meetings, during which papers of considerable interest had been read. Mr. M. B. Field was elected chairman, and Mr. Miles Walker vice-chairman for the next session.

Last week Mr. Horace Boot, electrical engineer to the Corporation of Tunbridge Wells, gave a lecture on the "Industrial Applications of Electricity."

The *Times* says that Sir A. B. W. Kennedy will take the chair at the Crystal Palace School of Practical Engineering on Friday at noon, on the occasion of the annual award of certificates.

Nottingham Guild of Mechanical and Electrical Engineers.—Last week Mr. H. Perkins, M.I.M.E, read a paper on "The Supply of Electricity in Bulk." A Yorkshire electric company, of whose operations the lecturer had intimate knowledge, now included amongst their customers, he said, no fewer than seven collieries.

University College Dinner.—The past and present engineering students of University College, London, will hold their annual dinner at the Trocadero Restaurant on Friday, May 3rd, at 7.30 p.m. This dinner will be specially interesting, as the Emeritus Professor of Engineering, Sir Alex. B. W. Kennedy, LL.D, F.R.S., president of the Institution of Civil Engineers, will be the guest of the evening. Prof. T. Hudson Beare will preside, and a large number of distinguished engineers will be present. Early application for tickets should be made to Mr. J. A. Smith, University College, Gower Street, W.C.

Institution of Civil Engineers (Students).—On Wednesday last the thirty-second annual dinner of the students of the Institution was held at the Trocadero, Sir A. B. W. Kennedy, F.R.S., occupying the chair. Besides a fair number of students and their friends, several members of the Institution were present. After the loyal toasts had been given by the Chairman, Mr. A. Carmichael proposed "The Institution, the Secretaries of the Institution, and Our Guests." He tendered thanks to Mr. Henderson (lately one of the secretaries), to the secretaries, and to the engineers whose works had been visited during the year. In his reply, the Chairman said that the men who were now guiding the Institution were doing their best to raise the standard of membership; the council preferred that members should first have been students. Some of the older living members had been pupils of the great men of the Victorian era, such as Robert Stephenson and Brunel, and had seen marvellous changes in their time; what would be commonplace things when they too were veterans? Engineering was the work of *to-day*; no matter if the designers were forgotten, so long as their work was properly done. Dr. Tudsbery replied on behalf of the secretaries, remarking that he had found that of the Students admitted 40 years ago, half were still alive and doing well. Mr. Bertram Blount replied for the guests, emphasing the cordial relations between chemists and engineers, which were destined to become still closer.

Col. R. E. Crompton proposed "The Students," claiming to be a student himself. There was no finality in sight; the unsolved problems of to-day were 10 times as big as those already solved. Mr. C. J. Guttmann replied, expressing the pleasure of the Students at seeing the senior members present, and hinting at the possibility of good appointments resulting. He referred also to the great value and high efficiency of the corps of E.E.R.E. (Vols.).

During the evening an excellent programme of music and song was provided by members of the Students' class, and it was plain that the function was heartily enjoyed.

Cost of Generating Electricity.—At a meeting of the New York section of the American Electro-chemical Society, held on February 26th, Prof. Charles E. Lucke presented a paper discussing in detail the various factors which enter into the cost of the energy consumed in electro-chemical industries, the source of power being water, oil, steam or gas. The oil-engine-driven station was assumed to contain six 160-kw. sets, four of which were to be in use constantly, the other two being held as reserve. In the gas-engine-driven station it was assumed that six 600-kw. sets were installed, two of which were held as reserve. The steam station was assumed to contain six 500-kw. units, four being in use constantly. In the water-power station the units installed were assumed to be operated continuously at full load. In each case it was further assumed that the total investment cost per year could be taken at 10 per cent. The operating cost was estimated from values found to obtain in practice. On the basis of the above assumptions the author presented the following table showing the cost of electrical energy obtained from the various sources, the values being in dollars:—

	Water.		Oil.	Steam		Gas.
	Min.	Max.	Mean.	Min.	Max.	Mean.
Initial cost per kw. ...	75·	200·	217·	110·	150·	270·
Investment cost per year per kw.	7·5	20·	21·70	16·5	22·5	27·0
Operating cost per kw.-year	1·	5·	56·9	52·5	52·5	38·5
Total cost of energy per kw.-year	8·5	25·	78·6	69·	75·	65·5

The German Electrical Industry in 1906.—The report of the Association for the Protection of the Economic Interests of the German Electrical Engineering Trade states that the year 1906 represented a period of the greatest activity since the foundation of the industry, and at the same time one of the greatest unrest, owing to external circumstances, mainly in regard to the raw material market. A complete strengthening took place in the economic situation of the electrical undertakings, and as a consequence the difficulties in which the industry was thrown on the collapse of the last period of industrial prosperity could now be regarded as having been removed. In this way manufacturers were able to derive advantage from the favourable economic situation in Germany and in other countries in the past year, and meet any of the demands made by consumers. A noteworthy matter was the endeavour of the large works to deal as much as possible with special branches of production on a large scale. Formerly there were only two large firms which made practically all classes of electrical goods, but a third has recently been added by the absorption of smaller firms and the starting of new branches. Some firms of medium size have followed this lead, and have also embarked upon new departments, and a further extension of this principle may be expected in the near future. However, the justification for the existence of the 250 to 300 special works seems to be in no way placed in doubt by this movement, as the electrical industry is in the first place one of delicate mechanical production in which the intellectual activity of the principals of the firms plays the greatest part. During 1906 the mining industry specially engaged the activity of the makers of electrical machinery and appliances, particularly for the working of winding engines, ventilating plant and pumps, and for haulage purposes both underground and on the surface. The increased production in the year caused an augmentation of from 15 to 20 per cent. in the number of workmen employed, and the total number of workers and officials rose from 82,000 in 1905 to from 95,000 to 100,000 in 1906. It was also found necessary to increase the working capital of the companies in order to deal with the expansion. The 32 companies concerned raised from £3,500,000 to £3,750,000, and this advanced the total capital from £31,750,000 in 1905 to £35,500,000 last year. If to these manufacturing works is added the capital invested in lighting and tramway undertakings, the aggregate investments in the electrical industry in Germany work out at £137,000,000 at the present time. According to Garcke's *Manual*, over 340 millions sterling is invested in British electrical industries.

Electrolytic Copper in Australia.—A Sydney correspondent of a German newspaper, in referring to the formation of the Electrolytic Refining and Smelting Co. of Australia, Ltd., terms the undertaking a new German enterprise, constituted for the metallurgical treatment of copper, gold and silver ores. The scheme aims at the diversion to the new company of the ores which are now mostly shipped to Europe and the United States, as the new works to be erected will embody the latest experience and the most modern designs. The capacity of the works from the beginning will be calculated on a sufficiently large scale to treat the whole of the production of blister copper in Australia. The principal parties interested in the new undertaking, whose share capital of £150,000 has been fully subscribed privately, are the well-known metal firm of Aron Hirsch and Son, of Halberstadt, and the Australian representative of the firm, Mr. F. H. Snow, the Queensland Mount Morgan Co., and the directors of the latter. Moreover, the Mount Morgan Co. has abandoned in favour of the new company its scheme for the establishment of a refinery of its own, the former's copper having hitherto been refined by the Delamer Copper Refining Co., of the United States, which has business relations with Aron Hirsch and Son. Captain Richard, the general manager of the Mount Morgan Co., is proceeding to the United States to investigate the process of electrolytic refining which is to be adopted for the new Australian works, of which he will be technical manager. The domicile of the new company will be Sydney, but a site has not yet been selected for the new works.

Football Match—Arc Works v. Others.—We have received the following matter which purports to be the report of a football match written by an electrical enthusiast:—

The field was bipolar. There were 25 players, 12 of each polarity and one who was in a state of oscillation; the latter was alluded to as the pole tester or referee. Of the other players, one on each side was called the wireman, because he ran along the wires at the sides. His duty was to wave his pliers when the rotor was repelled beyond the boundary of the field.

At the mouth of the pole stood the amortisseur or pole guard. Before him were two counter, or back E.M.F.'s; these tend to oppose any current setting towards their pole.

Three semi-back E.M.F.'s stood before them, whose duties were similar, and finally the uppermost layer consisted of five men, termed forward E.M.F.'s, or shortly "forwards," as they were purely unidirectional.

The rotor having been placed on the neutral point, the pole-tester blew the horn. The rotor strongly repelled from the nearest forward, immediately revolved rapidly towards the edge of the field. Another forward coming up with great velocity, the rotor was compelled to alter its axis of rotation, and this it had to do every time it came within the sphere of influence of a player.

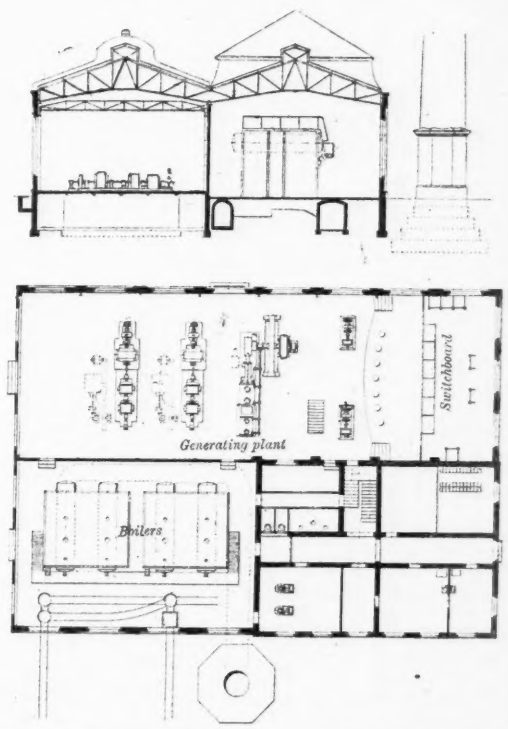
The explanation is, of course, simple. The rotor which is probably of hard steel with considerable coercivity, is strongly magnetised before the beginning of the match. The players, who were compelled to discard their ordinary clothing, all wore very large and heavy boots. Now this I noticed myself. On each side of their boots, over their ankles, was a small pocket containing dry cells of a very powerful nature. The sole of the boot consisted of laminations of thin steel, wound with many turns of wire, held in place by projecting insulating studs, thus giving a very strong magnet, on the approach of which the rotor was immediately repelled. That the boots were of opposite polarities was easily seen, for when a man put forward his right foot the rotor travelled to the left, and when he advanced his left foot the rotor went to the right. This, I say, I saw myself, so I know that it is so. The boots were carefully insulated from the foot by thick woollen stockings, and most of the players had an air-gap at the knee, probably to localise the effect of a fault. Sometimes when a man had come in contact with some other player's boots, he would hop about on one leg, rubbing the point of contact with his hands, having evidently received a severe shock.

I was so interested in these discoveries that I had not been following the gyrations of the rotor, but my attention was attracted at this instant; the rotor was slowly revolving towards me, two forwards equi-distant from it were advancing with haste; they meet; the rotor, unable to follow the direct line of either repulsion, was compelled by the parallelogram of forces to adopt a resultant path. With incredible velocity the rotor flew in my direction, struck down the unfortunate stator who was by my side, and fell harmless beyond. Dropping on my knees, I laid my hand upon his heart with but little hope. But fortunately he was not killed, wonderful to relate, he only appeared somewhat giddy. He spoke of the sanguinary rotor (but this I could not verify as it was again in use), said that it had caused a fine rotating field, and alluding to a tendency to sparking which his eyes had acquired, he stated that he would be all right after a thorough lubrication. Having made somewhat of a study of this latter subject, I accompanied him in case I might be of assistance, and am, therefore, I regret to state, unaware of how the match terminated.

February 30th, 1907.

Electro-chemical Notes.—Electric Smelting for the Foundry.—The following letter of R. Moldenke, secretary of the American Foundrymen's Association, to the Electro-chemical and Metallurgical Industry, is worthy of careful consideration. The average foundryman has constant calls for steel castings, which as a rule, are sublet to the foundries. The latter work for tonnage and do not like light weight, and as a consequence high prices rule. This applies also to malleable castings. A convenient and easily operated process therefore would immediately receive consideration, and for this purpose an electric smelting process seems to be ideal. A quick melting and very hot process, but one which does not punish the metal is required. To exclude chemical and physical changes would be ideal and an easy temperature regulation would solve many of the existing difficulties of the modern foundryman. The prevention of overheating during the fusion and the ensuring of a high temperature afterwards, would obviate the oxidation of the metal. It would also remove any existing evil of that kind by the use of ferro-manganese in the melt when it has been brought practically to a steel temperature, at which point the alloy will do its work. The induction furnace seems to fill the requirements best. The enormous steel production will always yield scrap enough to supply the demand for small castings, and might if properly selected be utilised. Such a process would be worked with profit in the brass-foundry where the loss of zinc and tin is very considerable. At present the crucible furnace gives the best metal, but is costly. Its advantage, however, might readily be incorporated with those of the electrical appliances to produce the highest class of product. The great foundry industry is ready to take up such a scheme as soon as the commercial feasibility is demonstrated.

American Electro-Chemistry for 1906.—The big furnace industry is still in a flourishing condition, the most important progress being due to Acheson, in the production of soft graphite. It is possible, however, that further developments of power from the Niagara Falls will be restricted by legislation. The electric furnace in its relation to iron and steel has attracted most attention, and the manufacture of ferro-alloys is now an established industry. In this connection, not only is ferro-chrome produced but also ferro-silicon in small quantities, this latter having been imported from Europe previously. The production of high-class tool steel in furnaces of the Héroult and the Colby-Kjellin types progresses, if somewhat slowly. With electric lamp filaments rapid strides have been made. Previously osmium, tantalum, and graphitised carbon lamps have been introduced, but still more revolutionary results have been obtained, notably with the tungsten lamp. Now the "Helion" lamp has arrived, but details of this are still very meagre. The electrolytic industries have been no less successful, aluminium naturally taking first rank. The production of sodium by the Castner process is steadily increasing. In this connection it is worthy of note that the Ashcroft process is now having a trial in Norway, where it is expected that considerable economy will be effected. In lead smelting several processes have been suggested, but none are used. The lead refining process of Betts is, however, in operation in America and in England, and is giving good results. With regard to the production of caustic soda and chlorine from common salt the situation remains unchanged. Both gold and silver are now refined electrolytically in Philadelphia and San Francisco. In the large copper refineries the capacity has been doubled within the last five years. The outlook, indeed, seems rosy! (*Electro-chemical and Metallurgical Industry.*—Vol. V, 1.)



The Electrical Equipment of the Teltow Canal.
(See next page.)

Plan and Elevation of the Teltow Generating Station.

THE ELECTRICAL EQUIPMENT OF THE TELTOW CANAL.

The meetings of the Royal Commission on Inland Waterways, which are now taking place, have to some extent renewed the interest which is felt in certain quarters as to the provision of efficient means for canal haulage.

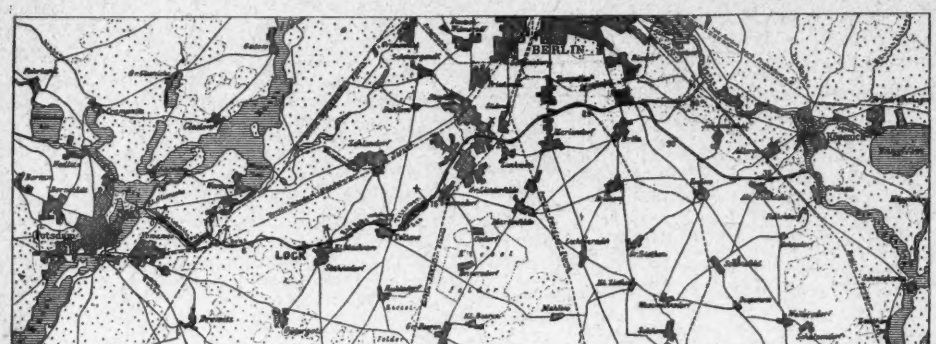


Fig. 1.—Plan of the Teltow Canal.

Dr. Marchant, in the course of his evidence before the Commission (see Electrical Review, March 8th last), gave some particulars as to the various systems of electric barge traction in use at the present time, together with the approximate cost involved, and referred specially to the Teltow canal installation, which we describe below.

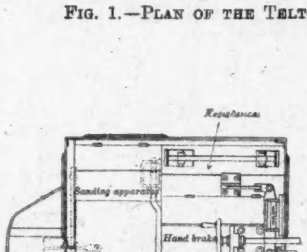


Fig. 2.—Plan of Locomotive Cab.

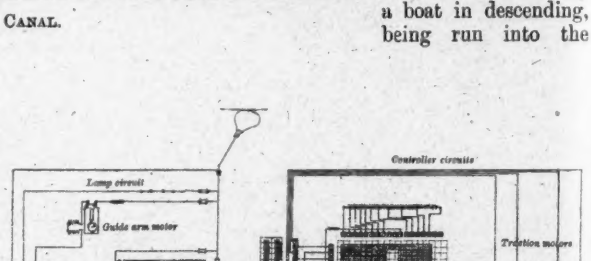
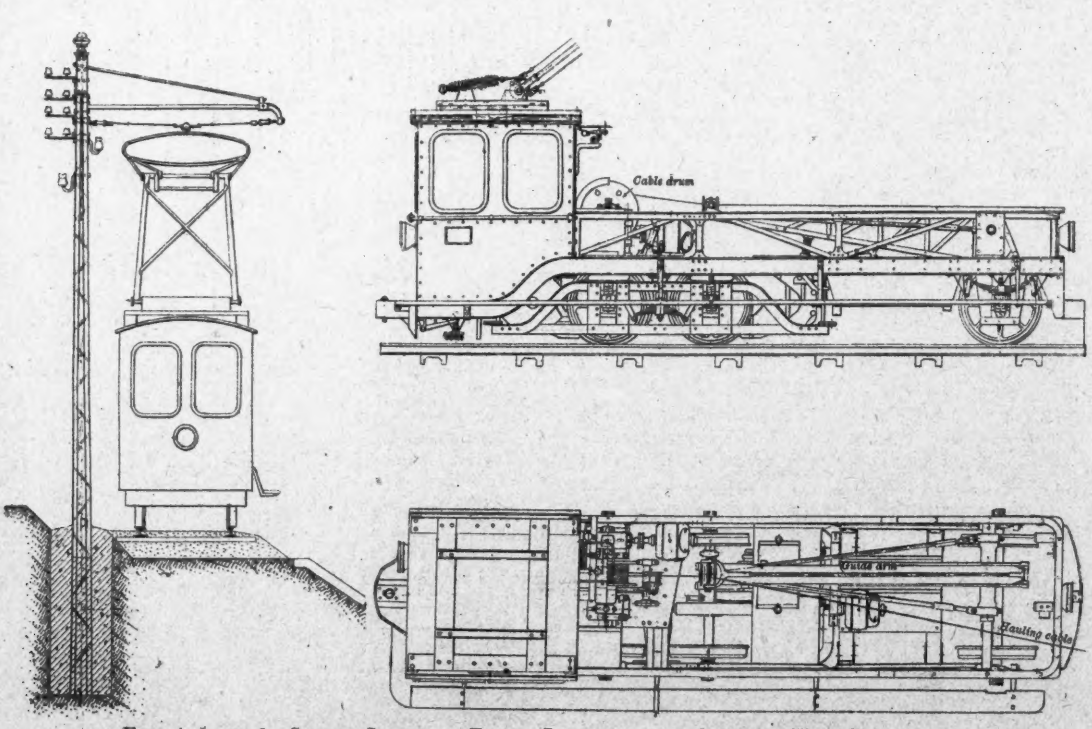


Fig. 3.—Diagram of Electrical Connections, Towing Locomotive.



Figs. 4, 5 and 6.—Siemens-Schuckert Towing Locomotive and Overhead-Wire Construction.

This canal (fig. 1) lies to the south of the city of Berlin, and connects, through duplicate arms with the River Spree, near Köpenick, also similarly with the Havel, near Potsdam and Wannsea; its length, including branches, is some 37 km., and its section some 21 m. by 2 to 2·5 m. deep. The canal boats in use draw some 1·8 m. of water, and carry about 600 tons each. As the difference in level between the Rivers Spree and Havel is some 29 m., a system of locks was constructed at Klein-Machnow, some 8½ km. from the Havel. The arrangement consists of two parallel locks, each 67 m. long by 10 m. wide, with a wide masonry division between. In the latter are constructed channels which allow of the water used by a boat in descending, being run into the other lock to assist in raising a boat proceeding in the opposite direction. The lock gates are counter-weighted and arranged to rise and fall vertically; they are each operated by

15 H.P., 220-volt, three-phase Siemens-Schuckert motors, through gearing which rotates a horizontal pulley shaft, from which the gates are suspended. Electro-magnetic brakes are provided to facilitate stopping.

During dry weather the water in the upper section of the canal is supplemented by pumping from the lower level, and at high water a certain proportion of water is allowed to pass through the masonry partition between the locks to the lower level — both operations being carried out through the agency of motors.

In its course the canal traverses several lakes, and the system of haulage was necessarily modified to suit local conditions. Thus at the lake of Griebnitz and in the vicinity of the Machnow lock electric tugs are employed, but over the remainder of the route electric towing locomotives (fig. 8) running on side tracks are in use.

The latter system of towage is by far the most extensive, the locomotives employed were supplied by Messrs. Siemens-Schuckert for hauling two loaded 600-ton canal boats, at a speed of some 4 km. per hour, and run on a metre gauge track, taking energy from a 500-volt overhead trolley wire by means of a bow collector. Each locomotive is mounted on a four-wheel truck, and a pair of trailing wheels; the former is fitted with two 8-H.P. series-wound D.C. motors, geared to the axles and operating at 500 volts and 800 R.P.M. In the front is a driver's cab, on the roof of which the collector is mounted. The tow-rope is a 10-mm. wire cable, and is attached to a winding drum behind the cab, the drum being operated through a friction coupling by a 3-H.P. motor, so arranged that when the pull on the tow-rope exceeds 1,200 kg., slipping will occur. The arrangement enables the locomotive to take up its load gradually, the drum slipping until the boat has attained a certain speed.

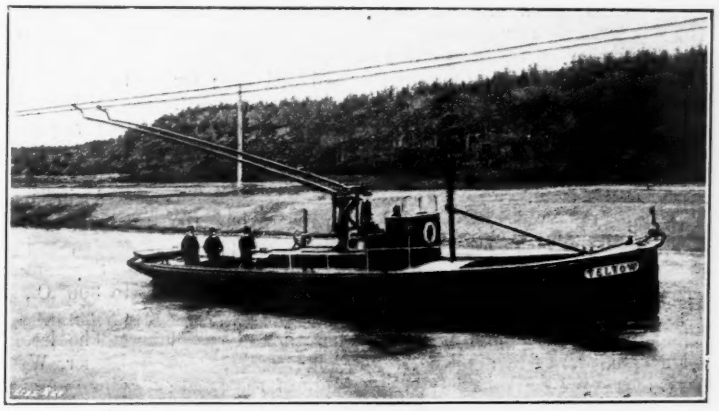


FIG. 7.—TRIPLE-SCREW TOW-BOAT WITH DOUBLE TROLLEY ARM.

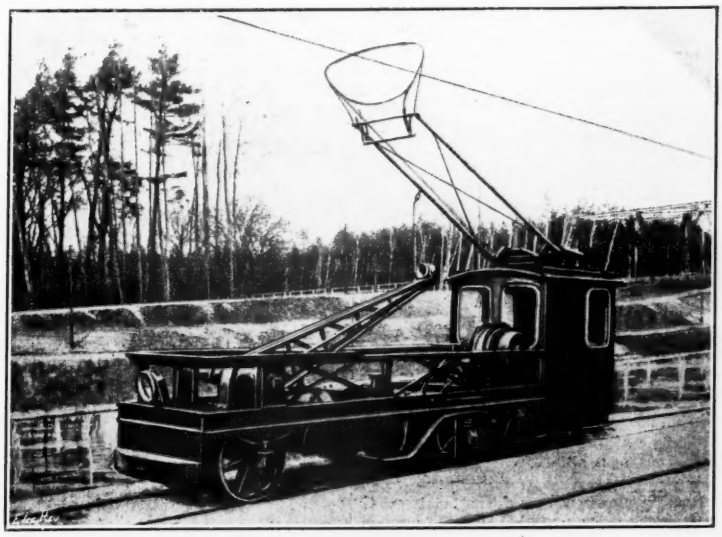


FIG. 8.—SIEMENS-SCHUCKERT TOWING LOCOMOTIVE, SHOWING GUIDE ARM AND BOW COLLECTOR.

The tow-line passes through the extremity of a guide arm, hinged to the framework of the locomotive, and which can be raised, if necessary, so as to lift the tow-line clear of obstructions; this arm also is operated through gearing, by a 3-H.P. motor mounted in the centre of the truck.

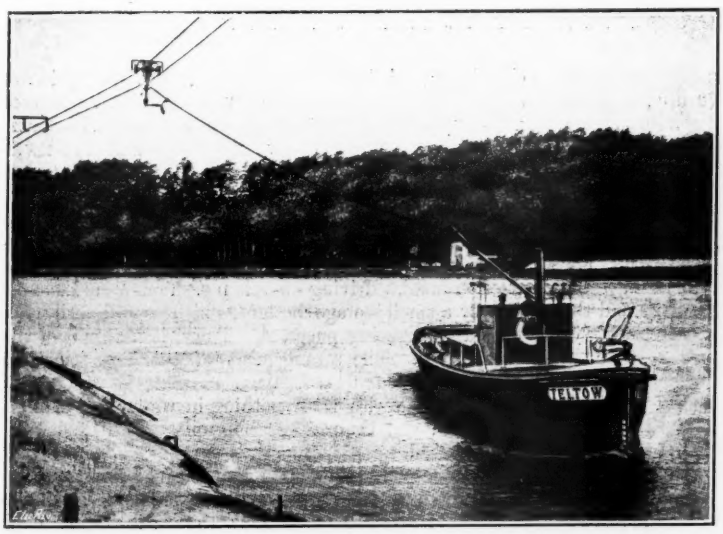


FIG. 9.—TOW-BOAT FITTED WITH LOMBARD-GERIN TROLLEY TRACTOR.

Fig. 3 shows the various circuits controlling the equipment. These latter include a lamp circuit, with five 110-volt lamps in series; the two 3-H.P. motor circuits, one of which (in connection with the hauling drum) is provided with a controller for speed regulation purposes, and the other with a reversing switch; the traction motor circuits, provided with series-parallel controller, &c. All movements are controlled by the driver from the cab, a plan of which is shown in fig. 2; the driver also has hand-brake and rail-sanding gear at his command.

Tests on these locomotives, according to *Le Génie Civil*, show that with a speed of 4 km. per hour, the resistance to traction per ton (approximate) was ·850 kg. and the energy consumption 3·5 watt-hours per ton-km.; at a speed of 4·5 km. per hour the resistance similarly was 1·035 kg., and the energy consumption 4·25 watt-hours, while at a speed of 5 km. per hour, the resistance amounted to 1·34 kg., and the energy required per ton-km., 5·25 watt-hours.

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The average efficiency of the locomotive was found to be some 65 per cent.

It will be noted in fig. 6, that the equipment of the locomotive is not symmetrically arranged, being, in fact, fixed on the side farthest from the canal, with a view to counteracting the tipping-up tendency due to the pull of the tow-rope, by throwing the weight on to the landward side; for the same reason the rail nearest the canal is super-elevated. The locomotive weighs 7,500 kg., and the driving and trailing wheels on the land side carry 1,900 and 550 kg. respectively, as compared with 1,380 and 390 kg. on the side nearest the canal.

The track rails weigh some 20 kg. per metre, and the trolley wire, flexibly supported on lattice poles, runs approximately 4·5 m. above the track, except under bridges where its height decreases to 3 m.

Fig. 4 shows a cross-section through the track.

The handling of the boats at the locks necessitated special constructional work and appliances. Parallel tracks, some 140 m. long, were laid on a pier in the middle of the canal; and special crane tractors running on these tracks are employed in hauling the boats into and out of the locks.

trolley motor had a tendency to lag behind the boat when the latter gathered speed under light load, and conversely it travelled ahead of the tug when the latter was towing several heavy boats.

Of the other systems employed, the operation of an alcohol motor-driven tug, proved too expensive, requiring 10 grammes of alcohol per ton-km.

A boat operated by power gas was not suitably equipped to give practical results; and a steam-driven boat, equipped with a boiler fired by heavy oil, cost per ton-km. some 5 centimes, hauling 1,200 tons at 4 km. per hour.

An independent power station, situated centrally at Teltow, supplies energy for the operation of the canal, and to one or two townships.

Steam at a pressure of 180 lb. per sq. in., and superheated to 300° C., is supplied from four water tube boilers to the engine plant shown in fig. 10.

The latter includes two 1,000-H.P. Zoelly turbines of Escher, Wyss make, driving in each case a 6,000-volt three-phase 50-cycle Siemens-Schuckert generator, and a 600-volt compound wound D.C. generator, mounted in tandem. The turbines are provided with high and low pressure expansion

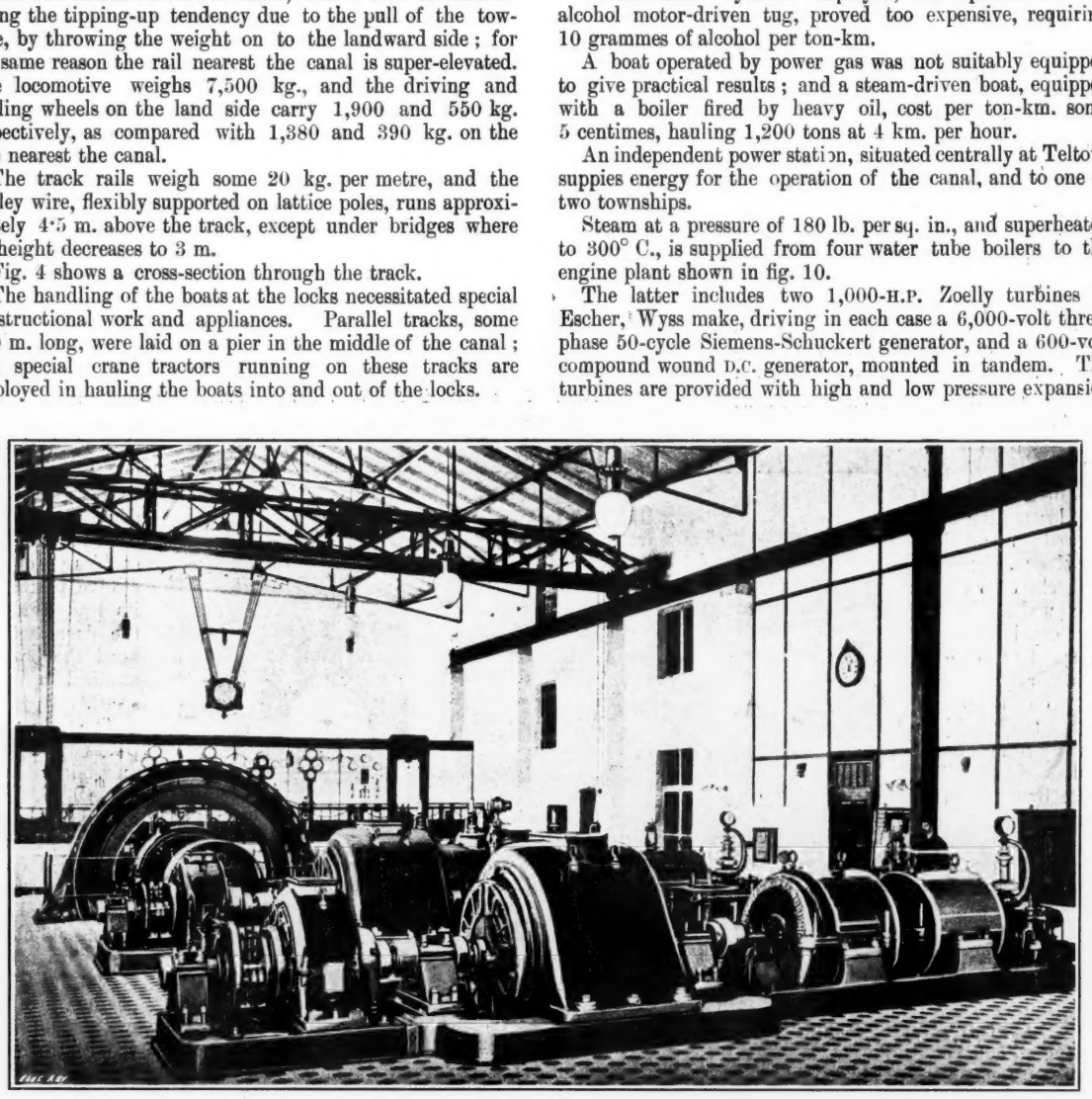


Fig. 10.—View of Generating Plant, Teltow Canal Power Station.

These tractors are operated by 600-volt D.C. motors, geared to the track; the motors are of 10 to 12 H.P., and are sufficient to haul a boat from a point about 350 m. from one end of the lock to a similar distance from the other end in half an hour. Some 60,000 to 70,000 tons per 24 hours can be dealt with in the parallel locks.

A variety of tow-boats have been employed on the canal, propelled by steam, gas and alcohol engines, also electrically-driven, but all are, more or less, experimental. For electrical propulsion, one equipment tried included three motor-driven propellers, the outer motors being of 20 and the centre one of 25 H.P., all being series wound. A battery of of 220 cells, with an output of 244 ampere hours on a 5-hour discharge, and weighing some 12 tons, supplied the necessary energy to the motors, and was recharged through double trolley arms from overhead wires as shown in fig. 7.

The energy consumption of this boat amounted to 9 watt-hours per ton-km. at a speed of 4 km. per hour; the system did not give more than 22 per cent. efficiency at the prescribed speeds, it also involved heavy first cost and maintenance. The trolley was frequently derailed, which necessitated the use of a battery.

A boat provided with a Lombard-Gerin motor-driven trolley (described in our issue of September 21st, 1900), was also tried, with better results, although in this case the

chambers; and the D.C. generators with auxiliary poles. The alternators are each of 650 KW., and the D.C. generators of 200-KW. capacity. In addition, a 300-H.P. horizontal engine, driving a 230-KW. alternator and 110-KW. D.C. generator is provided.

The steam turbines are jet condensing, and their steam consumption at full load is stated to be 6·1 kg. per H.P.-hour.

Excitation of the main units is provided for by 32-KW. motor-generators, consisting of 220-volt three-phase induction motors driving 65-volt D.C. shunt-wound generators, also by a small storage battery, which is ordinarily utilised for station lighting purposes. The switch-gear is of the oil-break type. The arrangement of the generating station is shown on page 641.

The load varies from nothing in winter and at night, to 500 H.P.; and the reciprocating unit is used during periods of light load.

A three-phase ring main for the canal service, runs west to a step-down transformer station at Schleuse, and eastward through two isolating stations to a sub-station equipped with two 150-KW. rotary converters, transformers and oil switch-gear, near Britz, the line proceeding further to Rudower Brucke. Tappings are taken off at alternate intervals from both sides of the ring main, and branch lines supply energy to the townships of Zehlendorf and Britz.

MAJOR W. A. J. O'MEARA, C.M.G., LATE R.E., M.I.E.E.

[The New Engineer-in-Chief of the G.P.O.]

It was announced in the *Times* of Saturday last that the Postmaster-General had appointed Major W. A. J. O'Meara, C.M.G., R.E., to be Engineer-in-Chief to the Post Office, in succession to Mr. John Gavey, C.B., M.Inst.C.E., whose retirement took effect on Monday last.

Some notes regarding the career of the new "chief" will be of interest. Major O'Meara was born at Calcutta in January, 1863. He joined the Royal Military Academy in March, 1881, and gained a commission in the Royal Engineers in February, 1883. After two years' study at the School of Military Engineering, Chatham, where he was awarded the Fowke Medal (for architecture), he proceeded to India and was posted for duty with the 2nd (telegraph) Company Bengal Sappers and Miners. On the outbreak of war in Burma in October, 1885, he proceeded to that country with the 5th Company Bengal Sappers and Miners, and was frequently engaged on reconnaissance duty. In January, 1886, he was severely wounded when expelling dacoits from a village near Pagan, and subsequently was mentioned in dispatches. He was later invalided home and underwent severe operations in order to regain the use of his right hand, but his health having broken down, the treatment had to be abandoned. After 19 months on sick leave, he was allowed to return to duty at Portsmouth, where for two years he was employed on the reconstruction of the defences of this dockyard. In June, 1889, he was posted for duty with the 2nd Division Telegraph Company Royal Engineers, and was employed for five years under the Post Office. During part of this time he was engaged in connection with the construction of the London to Paris Telephone Trunk line, and he was thanked by the Postmaster-General (Sir J. Fergusson) for his share in this work.

In 1894 he proceeded to South Africa where he commanded the 29th Company R.E. at Cape Town, and was engaged on the construction of the defences of Table Bay. After the Jameson raid Major O'Meara was sent with Colonel Morgan Crofton and Major (now Major-General) Plumer to Mafeking, to take over the arms and ammunition of the Chartered Co. In 1896 he was successful in a competitive examination for entrance to the Staff College, and returned to England in December of that year to spend two years at the Staff College, Camberley, where he graduated P.S.C. in December, 1898. He was appointed Staff Officer, Royal Engineers S. District, in January, 1899, and in June, 1899, was sent to South Africa as special service officer, and engaged on reconnaisance duties in the Orange Free State and Griqualand West till the outbreak of the Boer war.

He was invested in Kimberley from October 14th, 1899, to February 15th, 1900, and acted as Chief Staff Officer to Colonel Kekewich, and also performed the duties of Intelligence Officer, Press Censor, and Director of Telegraphs, owing to the small number of Imperial officers available in connection with the defence of the Diamond Fields. From Kimberley he proceeded to Paardeberg and was present during the final attacks, witnessing the surrender of Cronje. He was attached to the cavalry division staff during the operations leading to the occupation of Bloemfontein. On the arrival of the British forces in the Free State capital, he was appointed to the staff of the Military Governor, Bloemfontein, was Chief Intelligence Officer for Orange Free State, and raised and commanded the Provisional Mounted Police Force during the early days of the occupation. On the occupation of Johannesburg he was ordered to that City. The Burgomaster, Town Council, and Town Clerk were dismissed by the Military Governor, and Major O'Meara was appointed to take charge of municipal affairs. He acted as Mayor under these conditions for eleven months, and in a leading article in the *Times*, his rule was referred to as a "benevolent autocracy."

Major W. A. J. O'Meara, C.M.G., Engineer-in-Chief, G.P.O.

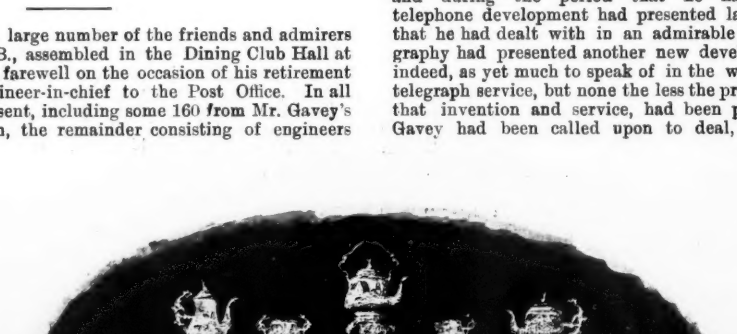
In May, 1901, when civil administration was being introduced into the Transvaal, he was appointed Government Commissioner of Johannesburg and district by Lord Milner. He was *ex-officio* chairman of the first Town Council, and on his retirement the Council had his portrait painted for the Town Hall, and passed a resolution thanking Major O'Meara for his services to the town. In a report made by the Mayor after the war, Major O'Meara's work was referred to in eulogistic terms. He was mentioned in dispatches by Colonel Kekewich for his services during the defence of Kimberley, and was awarded a C.M.G. for the first phase of the war: being also twice mentioned in dispatches to the Colonial Office by Lord Milner. Subsequently he was offered the position of Assistant Engineer-in-Chief, G.P.O., in April, 1902, and on his acceptance resigned his appointment in Johannesburg, and in April, 1903, retired from the Army.

MR. JOHN GAVEY'S RETIREMENT.

PRESENTATION AT THE POST OFFICE.

On Thursday last week a large number of the friends and admirers of Mr. John Gavey, C.B., assembled in the Dining Club Hall at G.P.O. North to bid him farewell on the occasion of his retirement from the position of engineer-in-chief to the Post Office. In all there were about 300 present, including some 160 from Mr. Gavey's personal staff in London, the remainder consisting of engineers and others from various districts in the provinces, Ireland, &c.; of officials who had retired from the service and had come back to welcome their old chief to their ranks; and a number of representatives of departments other than the Engineering, at St. Martin's-le-Grand, who were desirous of signifying by their presence their regard for the very popular chief of another department.

The largeness of the gathering, the heartiness of the proceedings, and the value of the presentations, together with the remarks that one frequently heard expressed by one and another while waiting for the proceedings to commence, all go to show how highly Mr. Gavey was esteemed by his old staff and friends. As it was his wish that his wife and daughters should be associated with him in any token that was to be presented, Mrs. and the three Misses Gavey were among the company.



POST OFFICE FAREWELL GIFT TO MR. AND MRS. GAVEY AND DAUGHTERS.

Mr. Babington Smith, C.B., C.S.I., Secretary to the General Post Office, presided over the proceedings, and before calling upon Mr. H. R. Kempe, M.I.C.E., chief staff officer, to make the presentations, he made a graceful speech concerning the services of Mr. Gavey. The purpose of the gathering had both an agreeable and a disagreeable side. It was always disagreeable to say "Good-bye!" to an old friend, but it was agreeable to have an opportunity of showing what their feelings were to that old friend at the time. Mr. Gavey had occupied the post of chief engineer at a period which had been one of peculiar anxiety and difficulty. It had been a period of new development. The telephone, which had taken its origin and developed to a large extent during what he might call the middle period of Mr. Gavey's service, took its large development in connection with the Post Office service at the time when Mr. Gavey had risen to the top of that service, and during the period that he had been chief engineer, telephone development had presented large and difficult problems that he had dealt with in an admirable manner. Wireless telegraphy had presented another new development. They had not, indeed, as yet much to speak of in the way of Post Office wireless telegraph service, but none the less the problems in connection with that invention and service, had been problems with which Mr. Gavey had been called upon to deal, and he had dealt with them in an admirable manner. Beside the difficulties of new development on the scientific and technical side, Mr. Gavey had also had to deal with difficulties which must be experienced by any head of a large department. In all of these things Mr. Gavey had shown a high standard of professional and technical skill, great tact and knowledge of men, a clear and incisive judgment, and he had set to the whole service a very high standard of upright, sound and conscientious work. His high qualities had been recognised outside the service as well, by his election to the presidency of the Institution of Electrical Engineers. Also, at the recent wireless telegraph conference at Berlin, when a large technical committee was appointed to deal with some technical aspects of the questions that had arisen, the presidency of that committee, with cordial and unanimous consent, was given to Mr. Gavey. The proceedings of the committee were conducted with unexampled conciseness, and not one single fault or flaw had been found in any decisions at which it arrived. There was not one of them who had come into personal contact with Mr. Gavey, who did not feel the greatest possible regret at their official severance from him. They had all learned to appreciate his cheerful energy and imperturbable good temper. He (the speaker) had himself been thrust into personal contact with him in many ways, and he thought he might never wish to have a colleague with whom it was more agreeable or pleasant to work. Mr. Gavey had elected to take the leisure he had earned a little before the inevitable time. None of them would grudge him that leisure, and they could only express regret that he should have felt

THE GAVEY PRESENTATION: SOLID SILVER TEA AND COFFEE SERVICE, AND KETTLE.

that the time had come for him to take his retirement, even a brief period before the extreme possible limit. Whether he would be content to plant his cabbages, or whether they would see a Gavey system of wireless telephony, remained to be seen, but they wished him health and long life to enjoy his leisure. Although his official connection might be severed, they hoped they had not seen the last of him.

Mr. H. R Kempe said that he undertook to make the presentation when it was pointed out that he could claim to have known Mr. Gavey officially longer, and to have been more closely associated with him, than any member of the existing engineering staff. A great number of Government friends not connected with that department had expressed the wish to be associated in the presentation, but it was thought by the committee that it would be more proper if the subscriptions were entirely confined to the engineering staff and members of the Post Office proper. That had accordingly been arranged for. When the Committee approached Mr. Gavey on the subject of what form he would like the presentation to take, he stated that he wished the whole of his family to be associated in the souvenirs. In asking Mr. Gavey to accept those souvenirs, he did so with very great pleasure and very great regret—with pleasure because the tokens were indications of the very great esteem in which he was held, and with regret since that gathering was the conclusion of a long and honourable official career. In the course of his own official career he had had occasion continually to visit various parts of the country, and had come into contact with numerous members of the staff of all grades. He could not help noticing the unanimous opinion—which had been expressed in the 35 years of his connection with the service—that Mr. Gavey was the coming man; and that when he rose to the highest position—that of engineer-in-chief—he would be the right man in the right place. If Mr. Gavey had elected to follow the profession of the ordinary civil engineer, he had no doubt that he would have left a very tangible monument to his skill and ability. Unfortunately, a telegraph engineer was hardly in a position to do so, as his great works were—as in the case of underground wires—carefully buried, and the public had no appreciation of the work done there, although they made nasty remarks when the operations had to be carried out. The fine ornaments which decorated our roadways and some of the finest buildings, were hardly looked upon by the public as being artistic productions, but Dr. Samuel Johnson was said to have made the statement with reference to a fine view: "Believe me, Sir, the finest scenery in the world is improved by the presence of a good hotel." Had he lived at the present day, no doubt he would have said: "Believe me, Sir, the finest scenery in the world is improved by a good main trunk telephone line in the foreground." The greatest monument to an engineer's ability was the fact that the general public knew but little of the colossal system that existed in this country. His reason for saying that was that the more perfect the machine the more silently and unobtrusively it did its work. That system worked with marvellous automaticity, and that good working was entirely due to the skill of an able, hard-working and accomplished staff, guided and controlled by the master mind and master hand of Mr. John Gavey. Mr. Gavey's service dated back over nearly half a century—46 years, he believed, was the actual time. He had seen many and various changes take place during that period. He had seen the healthy infant grow to be a healthy giant, and in all the changes that had taken place he had borne a very prominent and able part. The work of the engineer of the present day was by no means an easy one; he had not only to deal with engineering matters, but he had to be a diplomatist of the very highest type.

Sir John Lamb, who welcomed Mr. Gavey to join him on the retired list, condoled with those present on their loss. Mr. Gavey, he said, came to the Post Office with a reputation, from the old Electric and International Telegraph Co. He (the speaker) also referred to Mr. Gavey's connection with the valuation of the National Telephone Co.'s trunk lines, in which matter he had given complete satisfaction to both sides.

After other remarks from other speakers, Mr. Kempe made the presentations, which included a handsome roll-top desk and chair for Mr. Gavey; a solid silver tea and coffee service (130 oz.) and a solid silver kettle (50 oz.) for Mr. and Mrs. Gavey; and for the three daughters, two gold watches and a toilet case.

Mr. Gavey, on rising to respond, was received with most hearty and prolonged applause. Speaking at first with considerable difficulty, he said that, at one time, he rather prided himself upon being able to control his emotions, but, with so warm a reception, he found it very difficult to respond in suitable terms. The time had arrived when it was wise that he should hand over the burden of official life to younger shoulders, and the regulations of the Service, perhaps, tended much to their happiness, in so far as it compelled them to hand over that burden at a time when they could retire with full physical health and with mental vigour that might enable them to enjoy either the leisure of an idle time or the lighter applications which they might feel inclined to undertake. One could not contemplate without a pang the severance of the ties of friendship and goodwill that had existed for nearly half a century between himself and so many of those who were around him that day. He should have said the lessening, rather than the severance, but such lessening always necessarily followed one's retirement from official life, because retirement naturally removed the necessity for that close association which always took place between men engaged in one and the same work. On behalf of his wife and daughters, and on his own behalf, he thanked them for the splendid presentations which would remind them in future years of the kindness and good fellowship shown to him. When he sat down at that desk and endeavoured to solve difficult technical and financial problems, which in the past he had been able to call upon his skilled and technical officers to solve, he hoped that, without their skill, the mere fact that he sat at that table would cause him to be inspired by them, so that in that way he would alone find a way out of his difficulties. After referring to the great developments that had occurred since he joined the service in 1860, he added that there was a great work before them in telephone development. What it would extend to he thought nobody there could foretell. He went on to express in the warmest terms his appreciation of the support and assistance that he had had throughout the whole of his career from his colleagues in the various branches of the Post Office. He felt proud of commanding such a staff. He wished them all "God speed!" and hoped it was not entirely a farewell, and that probably he might feel inclined to do a little work in the direction in which he had laboured for some years; although not working so hard as at some times. He hoped to have many opportunities of meeting them either socially or professionally.

The gathering passed a hearty vote of thanks to Mr. Babington Smith for presiding.

The same evening (Thursday, April 11th) a complimentary dinner to Mr. Gavey was given at the Grand Hotel, Trafalgar Square. The Postmaster-General presided over a company of about 200, and among those present were Sir J. Denison Pender, Sir R. Hunter, Mr. H. Babington Smith, Mr. H. R. Kempe, Mr. M. F. Roberts, Major W. A. J. O'Meara, C.M.G., R.E., Dr. Glazebrook, Mr. R. Kaye Gray, Mr. A. P. Trotter, Mr. W. E. L. Gaine, Mr. J. Ardron, C.B., Mr. J. K. Logan (New Zealand), Mr. Alex. Siemens, Mr. Robert Hammond, Mr. J. E. Kingsbury, &c.

After the usual loyal toasts the Postmaster-General proposed the toast of the evening, and in doing so stated that letters of regret at inability to be present had been received from Earl Granard, Sir William Preece, Sir J. C. Lamb, Mr. S. C. Hooley, and others. He then proceeded to express the pleasure it gave him to preside over such a representative assembly gathered together to do honour to one for whom all had the greatest regard and the highest respect. He offered a word of welcome to them all, and was glad to see Mr. Gaine, Mr. Gill, and Mr. Goddard, who represented the National Telephone Co. They, like the Post Office, were carrying out a public service. Proceeding, he said: I must say a word of my own personal feeling in regard to our guest of this evening. I have had no long time of personal friendship with Mr. Gavey, but long enough to know he is a man for whom one can but feel sentiments of regard and attachment, long enough to recognise that he is one who does his duty in that state of life to which he has been called—does it admirably and does it zealously. I am glad, both officially and privately, to have this opportunity of saying something of what I feel in regard to him. I am not going to detail the many changes, the many advances which have been made since he began his work, but our guest of this evening has had some 45 years of service in electrical matters, and some 35 years' connection with the Post Office. I think he began his work under Mr. Preece in 1861, and joined the Post Office in 1871, and during this period he has rendered great services in various respects in regard to telegraphs, telephones and wireless telegraphy. As citizens we are grateful to him for the work that he has done in improving these various engineering works—works which are the life blood of the commercial interests of this great country. I also am under especial obligation to him for his work the other day at the Wireless Telegraph Conference. The British delegates did admirable work. It has been said that Mr. Babington Smith "ran the show," but Mr. Gavey, in his capacity as chairman of Committee, did a very great deal to obtain those regulations which were required for carrying on the work of wireless telegraphy. For his share in the results obtained he deserves our gratitude. I recollect also that last year he asked me to dine on the occasion of the reception of the foreign visitors of the Institution of Electrical Engineers, and I admired Mr. Gavey's courage on that occasion, because he made a speech in French to the French audience. This showed a man of very great courage. It was an admirable speech, too, and in excellent French. As I have said, I am not going to trace the great developments which the electrical industry has taken since Mr. Gavey became a public servant, but I think I may be excused for giving you one or two figures which show the immense strides which the Post Office has made in this direction under Mr. Gavey's advice, control and assistance. In 1870 there were 60,000 miles of telegraph lines, whilst last year there were 785,000 miles; and 20 years ago, the whole engineering staff of the Post Office amounted to 700, while it is now 2,500. Some may look back with regret to the days when these things did not exist. We may sympathise with the spirit of an Act which declares that railways and telegraphs, and similar dangerous devices should not be allowed; such an Act has, in fact, been in force in the Transvaal territory. It is as idle to look back to such days as those, as to regret the departure of those "wooden walls" which were once our protection. I was told of a man who had purchased some land. "I bought it," said he, "as God made it, but by a little expenditure I have made it into a veritable paradise." That is the view taken by my friend, Mr. Gavey, and his engineering colleagues in regard to developments of engineering enterprises. I am old enough to recollect when the telegraph first came into practical use. It was looked upon then as a somewhat dangerous invention, and certainly telegrams in those days were received with some trepidation, because people were chary about telegraphing on every subject as they do now. They telegraphed all the disagreeable news and wrote the agreeable ones. I heard of a man who received a telegram from a doctor saying, "Your mother-in-law is at the gates of death," to which the prompt and brief reply was "Pull her through." The telephone is a very recent invention brought into

practical use not very many years ago. Regarded then as practically a toy, its use is now so general that I saw in one of the French papers an advertisement "Confessions 12 to 4. Telephone No. 2,413." There are great drawbacks to the telephone from the Post Office point of view, for it is cutting into our postal revenue, taking the place of telegrams, and also cutting into the penny post—the sheet anchor of postal revenue. I am quite sure that the telephone is very bad for the national character. All of us who have the opportunity of using the national system must realise that our characters are deteriorating by the bad language we have to use in regard to it. It is said that since the telephone and golf and bunker have become so general the recording angel has increased his staff and also learnt double entry. I am not going to prophesy what is likely to be the future development of engineering ability applied to Post Office matters—I could do it with greater ease than Mr. Gavey, because I know nothing about it and he knows all about it—but I should not be surprised if wireless telegraphy were developed and other matters placed on the scrap heap. Mr. and Mrs. Zancig want neither telephones nor other apparatus. Telepathy is to be the medium of the future. I confess I do not look forward with much pleasure to that time when we are all to be able to read everybody else's thoughts. I am reminded of a conversation overheard the other day between two young ladies: "Oh, we were talking about you the other day!" "I wish I had been there." "No, you wouldn't." But such telepathic methods of communication are not yet available. Meantime we have the post, the telegraph and the telephone carried on as a great public service by a department of which Mr. Gavey has been an ornament for so many years. This great organisation is carried on very efficiently for the public welfare. In drinking to the health of our guest, we are glad to feel that for this 25 years he has given his best to the service. We regret his retirement, and in his retirement wish him God-speed and good luck in any work which he may undertake.

Mr. H. R. Kempe, in supporting the toast, said: When I was asked to undertake to second the toast of the "Guest of the Evening," I accepted with considerable pleasure, but at the same time with considerable diffidence, for I felt that the task might have been put into better hands than mine. At the same time, I felt that the selection was not altogether inappropriate, as I can claim to have officially known Mr. Gavey for a longer period, and in many matters to have been more closely associated with him than any other member of the engineering staff. You will all doubtless have anticipated that I should speak eulogistically of Mr. Gavey, and I may say that it is my intention to do so. At the same time, I feel that I must be careful of the manner in which I speak. A member of the Society of Friends, on being asked by a man who had made a somewhat flowery oration, what he—the Quaker—thought of his performance, replied, "Friend, thy speech was most eloquent, but I regret to say there was a fluency in thine utterances which did not savour of the truth." As I, fortunately, cannot claim the gift of fluency, I trust that what I have to say will be taken as an honest expression of opinion. It is now 35 years since I had the pleasure of making Mr. Gavey's acquaintance. At that period the telegraphs of the United Kingdom had recently passed from the hands of the companies into the hands of the State. Mr. Gavey acted as superintendent of one of the four districts into which the Southern Division was then divided, he having his headquarters at Bristol, and Sir William Preece (then Mr. Preece), who, I am sure, we all regret is not present with us this evening, being at Southampton as divisional engineer. Shortly after I joined the service, I was instructed to proceed to Bristol and report myself to Mr. Gavey, and I must confess that I did so with considerable trepidation, being new in the Service, and Mr. Gavey being quite unknown to me; but I have extremely pleasant recollections of the kindness and cordiality with which I was received when I made myself known to him. At the same time, I felt conscious that I was in the presence of a man of no ordinary personality, and a man of great strength of character, and I had an intuition that he was a man who was destined to come rapidly to the front. As time went on this feeling strengthened, and in conversation and gossip, which often took place amongst us, it was evident that the opinion was that Mr. Gavey was destined not only to rise very high in the Service, but to eventually occupy the very highest position. I do not propose to enter into details of Mr. Gavey's life, and of his service to the State; facts speak for themselves, and the fact that Mr. Gavey has not only attained the position of Engineer-in-Chief of the Post Office, but also that he has occupied the important position of President of the Institution of Electrical Engineers, and that His Majesty the King conferred a mark of distinction upon him, speaks volumes. I may, perhaps, however, add that prior to Mr. Gavey's coming to London, when any important problem had to be considered in the Engineer-in-Chief's office, it was invariably our custom to say: "Let us refer the matter to Mr. Gavey, and see what *he* has to say on the subject," and the opinion expressed by him, I need not say, proved of the utmost value. I have had the honour of serving under five engineers-in-chief—under Mr. R. S. Culley, who connected the past with the present; under Mr. Edward Graves, well-known for his great financial ability; under Mr. (now Sir William) Preece, whose abilities are so well known to you; under Mr. James Hookey, whose grasp and knowledge of all matters of detail covering the whole history of the telegraph system was remarkable; and lastly, but not least, under our guest, Mr. John Gavey. As chief succeeded chief, so did the difficulties of the work, so did the responsibilities, increase. At the present time I think I may say, without exaggeration, that the post of Engineer-in-Chief is anything but a sinecure. Not very long ago, I was endeavouring to distract my mind from matters official and matters scientific by turning over the pages of a volume of "Sketches from Punch"—and here I may remark, as the eye of the Postmaster-General is upon me, that I was not doing this in official time—when my attention was arrested by a picture which struck me as being extremely humorous, more so, perhaps, from the cleverness of the drawing than from the words at the foot; the scene represented was that of the library of a Cabinet Minister; the table was piled mountains high with official documents, some opened and some unopened, the chairs were similarly covered, and the floor was strewn with documents of all kinds; looking at the scene in amazement and consternation was a new footman, who remarks: "Well, if this is what master has to attend to, thank the Lord I am not Prime Minister." I have no doubt whatever that had the picture I have delineated been drawn at the present day, the words spoken, with some modifications in the surroundings, would have been: "Thank the Lord I am not engineer-in-chief to the General Post Office." If I have failed to speak as eulogistically of Mr. Gavey as might have been expected, it is due to the want of fluency of speech to which I have alluded, and in no way to want of appreciation of his high qualities. Mr. Gavey has served his country well, and I am sure you will all agree with me in wishing him and his family many years of health and happiness at this the termination of his long, his distinguished, and his honourable career.

Mr. J. Gavey, C.B., in responding, said: Mr. Buxton, Mr. Kempe, Mr. Babington Smith and gentlemen—It is very difficult for me to find words to express fully my feelings at the kind reception you have given me to-night, and at the warm terms of eulogy which have fallen from the Postmaster-General and from my very good friend Mr. Kempe. I think that if I were to take everything I had heard said to-day at the General Post Office, and here, too seriously to heart, I should go home a very vain man. All I can say is that in my simple way I have tried to do my duty. No man can do more, and if my efforts have been appreciated, it is a source of great satisfaction and gratification to me. It is a source of immense pleasure to find that this meeting is graced by the presence of so many men who are so eminent in the profession, to one branch of which I have the honour to belong. My period of service, as has been said, may be said to date back to the early days of telegraphy. I actually came under the tuition of Mr. Preece as early as 1860, and I received my first official appointment in February, 1861. It is, perhaps, a curious coincidence that in that month of February, 1861, the old semaphore telegraph, which was then working between the Mersey Dock, Liverpool, and Holyhead Mountain, was abandoned and replaced by the electric telegraph, and therefore I may, perhaps, say that my period of service connects that ancient system of telegraphing with the present developments. On that I may, perhaps, make a brief remark a little later. At the period to which I refer, even the electric telegraph was comparatively in its infancy and was only partially developed. The only service for most towns was through the railway telegraphs, and the citizens had to go down to the railway stations to despatch their telegrams. Submarine telegraphy was likewise in its infancy. A certain measure of success had been attained in shallow-water submarine cable laying, but, so far as deep-sea cable work was concerned, those interested in the enterprise had but met with disaster. The noble attempt to bridge the Atlantic in 1856 had failed. A further attempt to connect Great Britain with our great Indian Empire had likewise come to grief, but, gentlemen, I think I may say there were giants in the world in those days—giant capitalists, who were prepared to risk their money in developing a great and growing enterprise, and not in forming a corner in wheat or some other necessary article. There were giants amongst the electrical engineers—names which are honoured by those who were brought into contact with them in the early days, and by the younger generations that have read of them. And the combined work of those giant capitalists and those giant engineers led to the success which we all have lived to see. They established for the time being a great monopoly in submarine cable making. They laid cables, due to British enterprise and British capital, over the whole of the world, and for years they maintained for us a monopoly in cable communication that was the envy of every other nation. Whilst this was being done our system of land telegraphy continued to grow. A great step in advance was made when the Post Office acquired the telegraph service in 1870. Extensions were carried into every village throughout the country, and from that day until a comparatively recent one the progress of the Post Office telegraphs was one of continuous growth and development and of continuous increases in traffic. Then the telephone, the younger sister of the telegraph, came. This great system has not only come to stay, but it will certainly grow to an extent that, I think, few of us can imagine. It has been my good fortune to visit the United States on two occasions—on the last occasion in very pleasant company—and I had opportunities that are not afforded to many of looking into the developments of the telephone in America. In 1897 there were 350,000 stations. At the beginning of the present year that number had grown to 3,000,000, and that is not making allowance for the independent companies. The telephone is a far more workable instrument than the wireless telegraph. The particular branch of the service to which I have been attached has grown to an extent that no one could have foreseen in my early days. But it is but an emblem of the growth of the electrical industry that even in the last 25 years has been brought into every branch of manufacturing work. There is not a single branch of ordinary mechanical industry at the present moment in which electrical engineering does not take its part, and I am proud to have witnessed this great growth. To what extent it will continue it is not safe to say; but that it will continue, there is no doubt. This great gathering is, to a certain extent, a personal one, and you have honoured me by meeting me here to-

night not, I hope, to bid me farewell, but to bid me God speed in any other walk that I may eventually enter into. I should like to express the warm feelings of gratitude with which I regard you all, to thank you for the great honour you have done me in coming here to-night; to express my warm feelings to my colleagues of the Post Office, amongst others, without whose aid I could certainly have achieved nothing. I could express a similar feeling of gratitude to those outside my department. Whenever it has been my business to appeal to the great heads of the engineering service for advice or assistance, I have always received that advice and assistance—always given to me in the most cheerful manner. Then turning for a moment to the great Institution which represents the electrical industry. How much am I indebted to that Institution? For years I was in the provinces. When I came back to London in 1892 I was almost a stranger amongst the members of that Institution; the old generation had passed away, and was replaced by a new one; but, gentlemen, that made no difference, my kind friends took me by the hand, honoured me by office after office, until they promoted me to the highest honour of making me their president; but not only this, they postponed the general meeting in order that my friends in the Institution might be present here to-night. Gentlemen, I can only say I thank you all most heartily for the many kindnesses, the many evidences of friendship that you have showered on me. I feel this to be the happiest and the proudest day of my life.

Mr. Gaine could not quite understand by what irony of fate it had fallen to his lot to propose the toast of "The Post Office," a department with which he had had many subjects of controversy, until he believed that if the Post Office had any faults he knew them all. The Postmaster-General had very kindly mentioned his name and that of other representatives of the National Telephone Co. There were others members of the staff of the company present, but he noticed, as a coincidence, that the names mentioned by Mr. Buxton all began with the letter G, which suggested to his mind that the National Telephone Co. were the Gee Gee's, or willing horses, which earned a telephone revenue for the department. Then, passing from fluent and pleasant badinage, Mr. Gaine sketched the origin and development of the Post Office, and indicated what a wonderful organisation the Post Office really is. It was the right of every Briton to grumble, but when one considered the extraordinary amount of work involved, and how that work was done, and how extraordinarily well it was done, one was justified in considering the Post Office as a great and wonderful institution. He paid a high tribute to the care, the integrity, of the Post Office staff, and expressed his appreciation and regard for Mr. Gavey, who was worthy of all the kind words which had been said of him.

Mr. Babington Smith responded, and remarked that the official habit was difficult to shake off, so that he almost found himself beginning his speech with the words, "I am directed by the Postmaster-General to inform you." At some foreign watering places, he said, the method of treatment was first to submit the patient to a spray of warm water and follow it by a cold douche. That method was one to which the Post Office was accustomed. Pursuing the analogy along the lines of the criticisms usually levelled at the Post Office, he dealt with Mr. Gaine's humorous sallies like a skilful fencer of the lighter school.

The toast of "The Visitors" was proposed by Sir Robert Hunter, and responded to by Sir J. D. Pender and Dr. Glazebrook.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Battersea B.C. on Wednesday last week appointed Mr. H. F. J. THOMPSON, of Charlton, chief assistant electrical engineer. There were 117 applicants for the position, of whom six were interviewed by the Lighting Committee and three by the Council.

Mr. H. BLAKEY, of Guildford, has been appointed meter inspector in the electricity department of the Burnley Corporation. There were 49 applications.

The Galway Electric Co., Ltd, Newtownsmyth, Galway, have appointed Mr. PERCY SPALDING, A.I.E.E., as their manager, Mr. THOMAS O'HALLORAN having resigned the managership and being no longer in their employment.

Mr. HENRY JOSEPH, A.M.I.E.E., has left Melton Mowbray, where he held the position of engineer and manager to the local electric light company, in order to take up a similar position for Messrs. Edmundsons in connection with the Dorking electricity supply, and also for the Urban Electric Supply Co., Ltd., at Caterham. Before leaving Melton Mowbray, on the 11th inst. he was the recipient of a handsome case of pipes from the staff. The presentation was made by Mr. S. C. Hobson, one of the directors, and Messrs. J. C. Wigham and J. E. Edmundson were present.

Mr. HENRY GODFREY ANDREWS, assistant borough electrical engineer, Bournemouth, was married at Westbourne on April 9th to Miss Doris Agnes Lacey, eldest daughter of Mr. F. W. Lacey, borough engineer and surveyor at Bournemouth. Amongst the presents were a silver salver and barometer from the employés of the tramways and electricity departments.

Mr. O. F. FRANCIS, electrical engineer, Kirkcaldy, has asked that his salary be increased from £300 to £450 per annum. The Town Council is to consider application.

Mr. J. MARTIN BLAIR, electrical engineer to the Acton U.D.C., will represent that body at the 12th annual convention of the Incorporated Municipal Electrical Association at Sheffield, in June next.

The Chesterfield T.C. has passed a resolution asking Mr. ACLAND, the borough electrical engineer, not to accept outside work without the authority of the committee.

Mr. J. GRENVILLE ARDASEER, engineer-in-charge at the Cheltenham Corporation Electricity works, has resigned his position in order to take up an appointment in India.

Mr. W. J. CALDERWOOD, chief draughtsman in the Glasgow Corporation electricity department, has had his salary increased from £275 to £300.

Mr. W. W. LACKIE, chief engineer, and two members of the Glasgow Corporation Electricity Committee, are to attend the annual convention of the Incorporated Municipal Electrical Association at Sheffield, in June.

Tramway Officials.—Mr. LEONARD BELLAMY, of Liverpool, eldest son of the late Mr. C. R. Bellamy (who will be remembered as the former general manager of the Liverpool tramways) has been appointed assistant manager of the Rangoon Electric Tramways Co., and will leave Liverpool early in May for the purpose of entering upon his new post. Mr. Bellamy had a practical training in tramways constructional and engineering work in various parts of England before joining the service of Liverpool Corporation, in the capacity of assistant to his father. After the decease of Mr. C. R. Bellamy, the son continued to serve under the present general manager, Mr. C. W. Mallins.

The chief inspector of the Bath Electric Tramways, Ltd. (Mr. ROWLEY), has been presented with a pair of cruets and a marble clock by the officials, staff, motormen and conductors, on the occasion of his marriage.

General.—On Wednesday, April 10th, the sub-station staff of the Underground Electric Railways Co., of London, entertained Mr. WILLIAM CASSON, the retiring sub-station engineer, who is taking up a responsible post with the Central London Railway, at a dinner at the Central Restaurant, Haymarket. Mr. J. W. Towle, the resident engineer, presided, and presented on behalf of the staff an illuminated address and a case of razors, as a token of their regard. He spoke of the capable manner in which Mr. Casson organised, from the start of the company's operations, the whole of the sub-station department, which requires a staff of 90 to operate the 24 sub-stations. He also mentioned that he, as well as the sub-station staff, regretted losing such a capable officer. In responding, Mr. Casson thanked the staff for the way in which they carried out their work, and assisted him in the somewhat arduous duties of the post. The address was very tastefully designed, with a racy view of a seven-coach electric train as an inset. Amongst the toasts honoured were those of "The new Sub-station Engineer," to which Mr. P. R. Wray suitably responded, and the "Visitors," to which Mr. C. A. King, engineer of the District Railway, replied. During the evening songs were contributed by members of the staff and others.

On Friday, the 12th inst., Mr. RAYMOND F. FRY, of Epping, was presented with a solid silver cigarette case (suitably inscribed), as a mark of esteem, by his many friends of the Gilbert Arc Lamp Co., Ltd., of Chingford, on his leaving the firm after six years' service, to take up a position with William Coates & Son, electrical engineers, of Belfast, at the International Exhibition, Dublin.

Mr. E. A. UTTLEY, A.M.I.E.E., A.M.I.M.E., Government electrical engineer of Rhodesia, arrived home on Friday last, from Bulawayo, on a six months' visit to this country. Letters addressed to him, care of the ELECTRICAL REVIEW, will, from time to time, be forwarded to him.

Mr. F. NEWTON, who until recently was with Messrs. Vickers, Sons & Maxim, Ltd., has resigned his position of designer there to take over the management of the Potteries branch at Longton of Messrs. Newton Bros., engineers, of Derby.

Mr. S. M. HOPEWELL has resigned his position as motor superintendent at West Ham, and is joining the staff of the General Electric Co.

Mr. STEGMANN, electrical contractor of Clapham Junction, who met with a severe accident when at Putney last autumn, wishes to thank his friends for their kindly sympathy. He has now returned to business.

MESSRS. HANDLEY & SHANKS, of Birmingham, ask us to announce that Mr. Marshall Osborne is no longer in their service.

Obituary.—We learn with regret of the death of Mr. ARTHUR HIRST, chairman of directors of A. Hirst & Son, Ltd., of Crescent Works, Dewsbury, who passed away on Wednesday, 10th inst., at his residence, Jesmond Dene, Birkdale Road, after a long and painful illness. The interment took place at Dewsbury Cemetery on Saturday afternoon.

NEW COMPANIES REGISTERED.

Vincit Co., Ltd. (92,713).—This company was registered on March 26th, with a capital of £1,530 in £1 shares (1,500 preferred ordinary, and 30 deferred ordinary), to acquire and work the agency for Great Britain and the English Colonies of all "carborundum" and "electrite" products manufactured or sold by the Vienna Carborundum Co., to manufacture and deal in machines and appliances for engine building, acetylene, gas plant and agricultural implement manufacturing, electrical and general engineering, mathematical instrument making, motor and carriage building, saw, scale and weight and optical glass manufacturing, and other purposes, &c. The first subscribers are:—Col. L. Bonhote, 19, Cromwell Road, S.W., 10 deferred ordinary shares; S. Whitman, 6, Russell Road, Kensington, W., 10 deferred ordinary; J. F. Clarke, 22, Cambridge Street, S.W., gentleman, 1 preferred ordinary; D. J. G. Lawson, 5, South Bank Terrace, Surbiton, gentleman, 1 preferred ordinary share; H. L. Dimirddy, Blackheath Park, S.E., gentleman, 1 preferred ordinary share; P. Brewis, 86, Cromwell Road, S.W., gentleman, 1 preferred ordinary share; A. C. Worman, 3, Boundary Road, Wood Green, N., clerk, 1 preferred ordinary share; and E. Cowtan, jun., 43, Mortimer Road, Kingsland Road, N., shorthand writer, 1 preferred ordinary share. No initial public issue. The number of directors is not to be less than three or more than seven; the first are M. E. Souberbielle, The Cedars, Lyndhurst, Hants; and L. Bonhote and S. Whitman. Table "A" mainly applies.

Newarc Lamp Syndicate, Ltd. (92,801).—This company was registered on April 5th, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of and dealers in lamps, wires and lines, electricians, engineers, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in electrical apparatus, &c., and to adopt an agreement with R. P. Myers. The first subscribers (each with one share) are:—R. P. Myers, 51, Northcotte Road, Walthamstow, engineer; E. S. Templeton, M.A., A.M.I.C.E., 11, Cholmondeley Avenue, Harlesden, N.W.; A. Fulford, Overton House, Hadley Road, New Barnet, merchant; W. Blyth, 1, Leadenhall Street, E.C., clerk; P. J. Miller, 31, Lombard Street, E.C., solicitor; U. G. Dannay, 118, Leadenhall Street, E.C., engineer; and J. Gillespie, 1, Leadenhall Street, E.C., engineer. No initial public issue. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £250; remuneration, £150 each per annum (chairman £200), subject to profits exceeding 20 per cent. on the issued capital. Registered office, Leadenhall Buildings, Leadenhall Street, E.C.

Great Northern Central Railway of Colombia, Ltd. (92,784).—This company was registered on April 4th, with a capital of £400,000 in £1 shares, to acquire, construct, complete, equip, maintain, prolong and work railway and their appurtenances, tramways, telephone and telegraph lines and other means of communication in Colombia or elsewhere. The first subscribers (each with one share) are:—R. C. Howley, Elm Cottage, Wood Street, Walthamstow, clerk; J. H. Chapman, 57, Algernon Road, Lewisham, S.E., clerk; A. W. Lawson, 23, Park Avenue North, Hornsey, N., clerk; H. G. Harrison, 14, Woburn Square, W.C., gentleman; A. J. Swan, 18, Ashbourne Grove, Chiswick Lane, W., clerk; W. J. Yeoman, 23, Muschamp Road, East Dulwich, S.E., clerk; and S. H. Penwarden, 7, Comely Bank Road, Walthamstow, clerk. No initial public issue. The number of directors is not to be less than three nor more than 11; the subscribers are to appoint the first; qualification, £200; remuneration, £300 each per annum (£100 extra for the chairman), and 10 per cent. of the distributed profits divisible. The directors may borrow up to £1,752,520.

Aluminium Corporation, Ltd. (92,846).—This company was registered on April 10th, with a capital of £500,000 in 440,000 participating preference, and 60,000 ordinary shares of £1 each, to acquire certain freehold lands, water rights and properties comprised in agreements (1) with the North Wales Power and Traction Co., Ltd., and the Law Debenture Corporation, Ltd.; and (2) with the Aluminium Syndicate, Ltd. (promoters), and to carry on the business of manufacturers of and dealers in aluminium, electricians, electric and mechanical engineers, generators and storers of electricity, &c. The first subscribers (each with one share) are:—E. R. G. Wiggett, 220, Wellmeadow Road, Catford, S.E., clerk; H. Barnes, 351a, Wandsworth Road, S.W., clerk; C. J. Lunn, 17, Townsend Road, South Tottenham, clerk; A. P. D'Alessis, 18, Bassett Road, North Kensington, W., solicitor; W. Moir, 205, Queen's Road, Wimbledon, clerk; W. Newbert, 123, First Avenue, Manor Park, Essex, cashier; and H. W. Easun, 89, Mercers Road, Tufnell Park, N., clerk. Minimum cash subscription, 10 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the first are the Hon. Sir James Sivewright, Threadneedle House, E.C.; W. Beardmore, Parkhead, Glasgow (chairman of William Beardmore & Co., Ltd., and director of Vickers, Sons & Maxim, Ltd.); E. Manville, 29, Great George Street, S.W. (chairman of Daimler Motor Co., Ltd.); and W. A. Smith, 6, Hanover Street, Glasgow (chairman of Bryant & May, Ltd., and Argyll Motors, Ltd.). Qualification, £1,000; remuneration, £250 each per annum (£250 extra for the chairman), and 10 per cent. of the certified profits, divisible, payable only out of the surplus profits after 10 per cent. has been paid on the issued participating preference and ordinary shares. The participating preference shares rank first for a cumulative dividend of 7 per cent., after which a non-cumulative dividend up to 7 per cent. is to be paid on the ordinary shares. 40 per cent. of any balance still remaining is to be divided among the holders of the participating preference shares, and balance among the holders of the ordinary shares. In the event of winding-up, the participating preference shares rank in priority as to return of capital, and take 40 per cent. of any surplus assets. Registered office, Basildon House, Moorgate Street, E.C.

Premier Accumulator Co., Ltd. (92,855).—This company was registered on April 10th, with a capital of £40,000 in £1 shares (11,000 7 per cent. cumulative preference), to acquire the business of electrical engineers carried on by A. Schanschieff and H. Stephens at Northampton, as the "Premier Accumulator Co.," and to carry on the business of electrical and mechanical engineers and contractors, suppliers of electricity, manufacturers of, and dealers in, accumulators, batteries and railway, tramway, electric, magnetic, galvanic, telegraphic, telephonic and other apparatus, &c. The first subscribers (each with one ordinary share) are:—H. Stephens, 28, Hester Street, Northampton, electrical engineer; A. Schanschieff, 6, Park View, Far Cotton, Northampton, electrical engineer; T. Taylor, 10, Ladbroke Road, Holland Park, W., electrician; G. A. Schanschieff, 6, Park View, Northampton, electrical engineer; W. J. Green, 26, Ruskin Road, Kingsthorpe, Northampton, electrician; H. W. Pender, 21, Grove Road, Northampton, traveller; and W. S. Inman, Clarendon Chambers, 100, Mosley Street, Manchester, solicitor. Minimum cash subscription, £1,000. The number of directors is not to be less than two or more than five; the first are H. Stephens and A. Schanschieff; qualification, one share; remuneration as fixed by the company. Registered office, Cattle Market Road, Northampton.

Automobile Owner (London), Ltd. (92,847).—This company was registered on April 10th, with a capital of £100 in 1s. shares, to take over the business of printers and publishers of the journal known as the *Steam Car and Electromobile Review*, carried on by Polsue, Ltd., at 4 and 5, Gough Square, Fleet Street, E.C. The first subscribers (each with one share) are:—G. L. Polsue, 101, St. James' Road, Wandsworth Common, S.W., printer; T. C. Polsue, 45, St. James' Road, Wandsworth Common, S.W., printer; W. E. Humpheys, 67, Chancery Lane, W.C., journalist; R. N. P. Humphrey, 67, Chancery Lane, W.C., journalist; H. R. Shury, 70, Grande Parade, Harringgay, N., stationer; J. C. Leonard, 12, White Hart Square, Lambeth, S.E., clerk; and Florence Coaker, 36, Asplins Road, Tottenham, typist. No initial public issue. The number of directors is not to be less than two or more than three; the subscribers are to appoint the first; qualification, £10 shares or stock; remuneration as fixed by the company.

British Electromobile Co., Ltd., (92,815). — This company was registered on April 8th, with a capital of £25,000 in £1 shares, to acquire the business of electrical engineers and motor-carriage makers carried on by the Carl Oppermann Electric Carriage Co., Ltd., to acquire from C. T. J. Oppermann and others certain inventions relating to electric appliances and apparatus, and to carry on the said business and that of jobmasters, suppliers of electricity and other power, &c. The first subscribers are:—R. S. Mickel, Portland Court, W., contractor, 500 shares; A. Kennedy, Castlebank House, Anniesland, Glasgow, contractor, 500 shares; D. Watson, 102, Charing Cross Road, W., electrical engineer, 500 shares; C. T. J. Oppermann, Villa Riva, Tollington Park, N., electrical engineer, 500 shares; C. F. G. R. Schwerdt, Old Alresford House, Alresford, Hants, chairman of Speyer, Schwerdt & Co., Ltd., 500 shares; J. S. Mallam, 1, Queen Victoria Street, E.C., C.A., one share; and H. M. N. Pothecary, "Crete," Derby Road, Woodford, solicitor, one share. Minimum cash subscription £10,000. The first directors are R. Mickel, A. Kennedy, D. Watson, C. T. J. Oppermann and C. F. G. R. Schwerdt. Qualification, £500. Registered office: 1, Queen Victoria Street, E.C.

Anglo-Norwegian Aluminium Co., Ltd. (92,830).—This company was registered on April 9th, with a capital of £110,000 in £1 shares, to acquire and utilise the water power obtainable at the Vigeland Falls, on the Otterdal River, near Christiansand, Norway, for the purpose of manufacturing aluminium or other electro-chemical or metallurgical products, to adopt agreements (1) with V. Brug and (2) with J. C. Hawkshaw, and to carry on the business of winners, producers, and workers of aluminium, sodium, iron or other metals and their alloys, explorers (particularly in relation to metals and minerals and the development of electricity), &c. The first subscribers (each with 500 shares) are:—E. C. Hawkshaw, 33, Great George Street, Westminster, C.E.; W. B. McNewan, Stansted, Chislehurst, banker; N. Vannpaham, 5, Queen Anne's Gate, Westminster, C.E.; F. R. Hodgson, 77, Eaton Square, S.W., Member of Lloyds; Col. H. B. Jeffreys, 94, Piccadilly, W.; A. A. C. Verinton, 66, Victoria Street, S.W., engineer; and O. Hawkshaw, 33, Great George Street, Westminster, C.E. No initial public issue; the number of directors is not to be less than five or more than nine; the subscribers are to appoint the first; qualification £500; remuneration £1,500 per annum, divided.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hobart Electric Tramway Co., Ltd. (35,926).—This company's annual return, made up to October 18th, 1906, was filed on February 18th, 1907; 45,130 shares had been taken up out of a nominal capital of £105,000 in £1 shares; £1 per share has been called up on 25,130, resulting in the receipt of £25,130; 20,000 shares are considered as fully paid. Mortgages and charges: £61,425.

Electrolytic Alkali Co., Ltd. (Middlewich).—Issue on February 11th, of £1,650 4½ per cent. first mortgage debentures, part of series created on July 9th, 1904, to secure £50,000, charged on the company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool. Previously issued of same series: £25,600.

Archibald J. Wright, Ltd. (79,117).—This company's annual return was filed on January 14th, when 2,007 ordinary and six deferred shares had been taken up out of a nominal capital of £3,000 in 2,980 ordinary and 20 deferred shares of £1 each; £7 has been received and £2,006 is considered as paid. Mortgages and charges: Nil.

British Westinghouse Electric and Manufacturing Co., Ltd. (62,919).—This company's annual return was filed on February 14th, when the entire capital of £3,250,000 in 500,000 preference shares of £5 each, and 75,000 ordinary shares of £10 each had been taken up. £2,500,000 has been paid on the preference and £750,000 is considered paid on the ordinary. Mortgages and charges: £1,241,353. (Resolution to reduce capital to £1,875,000 in 500,000 preference shares of £3 each, and 75,000 ordinary shares of £5 each, passed January 14th, and confirmed February 4th, 1907.)

Electric Law Press, Ltd. (London), (72,435).—Issue on February 28th of £100 7 per cent. debentures, part of series created November 9th, 1905, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £850.

Halpin's Patent Thermal Storage, Ltd. (73,347).—This company's annual return was filed on January 15th, when 10,705 shares had been taken up out of a nominal capital of £12,000 in £1 shares; 10s. per share has been called up on 4,405, and £1 per share on 300 shares, and £2, 02 10s. has been received; 6,000 shares are considered as fully paid. Mortgages and charges: Nil.

Electric Equipment and Securities, Ltd. (72,015).—This company's annual return was filed on January 15th, when 92,292 shares had been taken up out of a nominal capital of £100,000 in £1 shares; £1 per share has been called up on 657 and 4s. per share on 29,595 shares, resulting in the receipt of £6,576; £85,716 is considered as paid, being £1 per share on 62,040 and 16s. per share on 29,595. Mortgages and charges: Nil.

Mechanical and Electrical Power Co., Ltd. (62 314).—This company's annual return was filed on January 29th, when 4,107 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £1 per share has been called up on 107, resulting in the receipt of £100. £7 remains in arrears. 4,000 shares are considered as fully paid. Mortgages and charges: Nil.

Universal Telephone and Electrical Co., Ltd. (68,317).—This company's annual return was filed on February 28th, when 400 ordinary and 400 founders' shares had been taken up out of a nominal capital of £10,400 in 2,000 ordinary shares of £5 each, and 400 founders' shares of £1 each. £2 10s. per share has been called up on 400 ordinary, and £1,000 has been received. £400 is considered as paid on the founders'. Mortgages and charges: Nil.

Adelaide Electric Tramways, Ltd. (65,676).—This company's annual return was filed on January 22nd, when 7 shares had been taken up and paid for in full out of a nominal capital of £3,000 in £1 shares. Mortgages and charges: Nil.

Durham Collieries Electric Power Co., Ltd. (83,421).—A memorandum of satisfaction in full of a charge dated October 25th, 1906, securing £18,000, has been filed.

Johnson, Hurley & Martin, Ltd. (electrical and motor engineers, Coventry), (91,680).—A 7 per cent. debenture, dated February 18th, 1907, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: G. W. Mands, Temple Lodge, Trafalgar Road, Moseley.

Bi-Centric Insulating Co., Ltd. (Birmingham). (76,234).—Issue on February 21st of a £150 consolidated debenture (representing three debentures of £50 each), part of series created same date to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Buenos Ayres Electric Tramways Co. (1901), Ltd. (71,206).—An acknowledgement of indebtedness under seal, dated March 7th, 1907, to secure a further £1,600 second or "B" debenture stock, supplemental to a trust deed dated March 30th, 1906, making, with £50,000 already covered by such deed, £51,600 out of a total authorised sum of £100,000 second debenture stock, has been registered. Property charged (as a second mortgage): Tramway concessions, freehold land and the company's undertaking and other property, present and future, including uncalled capital. Trustees: W. Greenwell, 2, Finch Lane, E.C., and F. C. Tiarks, 145, Leadenhall Street, E.C.

Thompson, Ritchie & Co., Ltd. (35,835).—This company's annual return, made up to November 27th, 1906, was filed on January 29th, 1907, 200 preference and 140 ordinary shares have been taken up out of a nominal capital of £5,000 in 200 preference and 300 ordinary shares of £10 each; £10 per share has been called up on 170 shares, resulting in the receipt of £1,700; £1,700 is considered as paid on the remaining 170. Mortgages and charges: £1,900.

Atlas Carbon and Battery Co., Ltd. (34,857).—This company's annual return was filed on March 7th, when the entire capital of £2,000 in £1 shares had been taken up; £8 has been received, and £1,992 is considered as paid. Mortgages and charges: £3,000.

Electrolytic Alkali Co., Ltd. (Middlewich), (64,360).—Issue on March 4th of £1,000 4½ per cent. debentures part of series created July 9th 1904, to secure £50,000, charged on the company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool. Previously issued of same series, £27,250.

Madras Electric Tramways (1904), Ltd. (80,361).—A trust deed dated February 28th, 1907 (Supplemental to deeds dated March 18th, 1904, and July 20th, 1906), to secure £11,000 5 per cent. mortgage debenture stock, has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Anglo-American Debenture Corporation, Ltd., 20, Birchin Lane, E.C.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997) — Issue on February 28th of £58,000 4½ per cent. debentures part of series created February 15th, 1906, to secure £250,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series, £127,300.

Electric Safety Appliances Co., Ltd. (83,864).—This company's annual return was filed on February 6th, when the entire capital of £2,000, in 300 founders' and 1,700 ordinary shares of £1 each has been taken up. £2,000 is considered as paid. Mortgages and charges: £1,000.

Buenos Ayres Grand National Tramways Co., Ltd. (28,374). —This company's annual return was filed on January 23rd, when 113,436 ordinary, and 90,000 preference shares had been taken up out of a nominal capital of £1,075,000 in £5 shares (125,000 ordinary and 90,000 preference). £1,017,180 is considered as paid. Mortgages and charges: £1,052,023.

Fife Electric Power Co., Ltd. (75,736).—This company's annual return was filed on January 17th, when the entire capital of £30,000 in £10 shares had been taken up and paid for in full. Mortgages and charges: Nil.

Mann, Egerton & Co., Ltd. (Electrical Engineers, Norwich), (83,783).—Issue on March 13th of £300 5 per cent. debentures, part of series created April 1st, 1905, to secure £10,000, charged on certain freehold and leasehold properties in Norwich and Ipswich, and the company's undertaking and property, present and future, including uncalled capital. Trustees: G. F. Buxton, Dunston House, Norfolk; and J. J. D. Paul, Eaton Grove, Norwich. Previously issued of same series, £9,700.

Douglas Southern Electric Tramways, Ltd. (45,701).—This company's annual return was filed on February 16th, when 25,973 preference and 15,472 ordinary shares had been taken up out of a nominal capital of £50,000 in 30,000 preference and 20,000 ordinary shares of £1 each. £1 per share has been called up on 12,566 preference and 5,804 ordinary, resulting in the receipt of £18,370. £23,075 is considered as paid on 13,407 preference and 9,668 ordinary. Mortgages and charges, nil.

Electric Safety Appliances Co., Ltd. (83,864).—Issue on March 14th of £100 5 per cent. debentures, part of series created November 7th, 1906, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £800.

Dulverton Electric Lighting Co., Ltd. (80,071) —£2,000 5 per cent. debentures, created by special resolutions of September 26th and October 24th, 1905, and dated March 12th, 1907, charged on the company's undertaking and property, present and future, have been registered. No trustees.

Newquay Electric Light and Power Co., Ltd. (85,451).—Issue on March 12th of £1,000 5 per cent. bonds, part of series created June 30th, 1906, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £2,600.

Europe and Azores Telegraph Co., Ltd. (39,452).—This company's annual return was filed on February 8th, when the entire capital of £200,000 in £10 shares had been taken up. £10 per share has been called up on 14,432, resulting in the receipt of £144,320. £55,680 is considered as paid on 5,568 shares. Mortgages and charges: Nil.

Londonderry-Moville Electric Railway Syndicate, Ltd. (75,455).—This company's annual return, made up to December 31st, was filed on January 22nd. 6,507 shares have been taken up out of a nominal capital of £10,000 in £1 shares. £1 per share has been called up on 1,507 shares, resulting in the receipt of £1,435 5s. £81 15s. remains in arrears. 5,000 shares are considered as fully paid. Mortgages and charges: Nil.

Conduit and Insulation Co., Ltd. (50 527).—This company's annual return, made up to October 26th, 1906, was filed on February 22nd, 1907. 33,878 shares have been taken up out of a nominal capital of £40,000 in £1 shares. £1 per share has been called up on 15,878, resulting in the receipt of £15,871. £7 remains in arrears. 18,000 shares are considered as fully paid. Mortgages and charges: Nil.

CITY NOTES.

The North Metropolitan Electrical Power Distribution Co., Ltd.

The ninth ordinary general meeting of this company was held on Thursday of last week at the offices, 101, Finsbury Pavement, Mr. J. Devonshire presiding. A representative of the Electrical Review, who attended to report the proceedings, was informed that the meeting was private.

The directors' report for 1906 stated that the total capital expenditure at December 31st, 1906, including expenditure on the promotion of additional provisional orders, amounted to £49,610. The large increase for the year was almost entirely to be attributed to the outlay upon the Enfield undertaking. The total revenue for the year (including interest receivable, £133) amounted to £6,570, plus £171 brought forward, making £6,741. After deducting the expenditure, which amounted to £6,409 (including interest on loans, £857), there was a balance of £333, which has been carried to the depreciation and reserve fund. After deducting £525, being an amount written off for sundry provisional orders abandoned or revoked, and £459 for the loss on the sale of the old battery at Barnet, the depreciation and reserve fund shows a credit balance of £99.

During the year under review practically the whole of the energy required for the Barnet electric supply undertaking was purchased from the North Metropolitan Electric Power Supply Co., and a proposal received from that company to purchase the generating station resulted in the sale being effected as from October 1st, 1906. The capital expenditure upon the Barnet undertaking has consequently been reduced, and stands at £13,523. The gross revenue for the year was £3,941, and the expenditure £3,392. There were connected to the mains the equivalent of 14,156 8-c.p. lamps, an increase of 3,862 lamps, or 37 per cent.

A supply was commenced at Enfield on September 20th, 1906, the electrical energy being purchased from the North Metropolitan Electric Power Supply Co., and transmitted from that company's station at Brimsdown. The capital expenditure upon the Enfield undertaking amounted to £24,261. The gross revenue for the period September 20th to December 31st, 1906, was £145 and the expenditure £268. There were connected to the mains the equivalent of 2,168 8-c.p. lamps.

The capital expenditure to December 31st, 1906, upon the Hertford electric supply undertaking amounted to £9,520. The gross revenue for the year was £2,329, and the expenditure £1,426. There were connected to the mains the equivalent of 10,263 8-c.p. lamps, an increase of 2,260 lamps, or 28 per cent.

The Cheshunt, East Barnet Valley and Wealdstone Electric Lighting Provisional Orders promoted by the company were confirmed by the Electric Lighting Orders Confirmation (No. 7) Act, 1906, and an agreement has been entered into with the Wembley U.D.C. for the transfer of the Wembley Electric Lighting Order (1906) to the company.

A new agreement has been entered into with the North Metropolitan Electric Power Supply Co., giving the company more favourable terms for the purchase of energy in bulk from that company than were in force under the original agreement, which is now superseded. Mr. W. L. Madgen offered himself for re-election as a director.

The Kalgoorlie Electric Tramways, Ltd.

The third ordinary general meeting of the shareholders of this company was held on Thursday of last week at Oxford Court, Cannon Street, Mr. Allen H. P. Stoneham presiding.

In proposing the adoption of the report (see Electrical Review, April 12th, p. 609), the Chairman said the net profit for the year had amounted to £17,546, against £15,942 for the previous 12 months. That was not quite such a large increase as they had hoped for, but still it was a substantial increase. There had been a slight decrease in the takings of the tramways, chiefly owing to the 6d. fares which were charged on race days. Their cars had travelled 673,560 miles, and carried upwards of three million passengers. There was no doubt that the great extravagance which at one time existed in Kalgoorlie had disappeared, and the town was now settling down into a sound commercial centre, and the outlying towns were also extending and becoming perfectly stable towns. They had had one great disappointment in the year for which they were in no way responsible, which was that the Trans-Continental Railway had not yet been commenced. The Bill which was introduced into the Federal Parliament for that purpose last year was lost, the votes being equal. However, the Bill would be brought forward again this year, and he did not think there was the slightest doubt that it would pass. Those who, like himself, invested their money pretty largely in the Kalgoorlie tramways, did so in the full expectation that Kalgoorlie would develop into a big city, and personally he believed that the shares of the company would ultimately rise in value, and that big dividends would be earned before the termination of the concession. The debentures he regarded as a perfectly safe investment, while as to the shares, he looked upon them as an exceedingly profitable lock-up.

Mr. Oliver Wethered seconded the motion.

Replying to questions by shareholders, the Chairman said that the receipts from the tramway for the first three months of the current year had amounted to a little under £12,000, which was practically the same as in the corresponding period of 1906. Every endeavour was made to keep the expenses as low as possible, and the directors had voluntarily reduced their fees for the current year from £1,000 to £600. They had a very good working arrangement with the Kalgoorlie Power Co., which would last for a good many years, under which they only paid 2¾d. per unit for power instead of 4d. As that reduction only came into effect last April, the full benefit had not yet been felt. They had arranged with Mr. Somerset, the manager of the Perth tramways, to look into the question of the expenses at Kalgoorlie, but the great trouble there was the question of wages. The trades unions were very powerful, and, to a great extent, they were compelled to pay what the men demanded.

The report was adopted.

Potteries Electric Traction Co., Ltd.

The directors' report for 1906 states that there was expended on capital account during the year an amount of £12,700 on the extension of feeders, purchase of five additional cars, and on the acquisition of a new car-shed, &c. In accordance with the resolution passed in November, 1906, each £10 ordinary and preference share has been split into 10 shares of £1 each. The total revenue for the year amounted to £109,267. The traffic receipts amounted to £94,878, an increase of £4,609. After deducting all expenses chargeable to revenue, including £11,230 debenture and other interest, there remains a surplus of £26,942, making with the £724 brought forward an available balance of £27,666. Out of this there is placed to renewals fund £2,500; is transferred to depreciation and reserve fund £2,500; dividend (5 per cent. per annum) on the cumulative preference shares absorbs £12,250; and a dividend (4 per cent. per annum) on the ordinary shares requires £9,800, leaving £617 to be carried forward. During the year £7,766 (as compared with £2,525) has been expended on the improvement, renewal and repair of the permanent way, and of this amount £6,289 has been charged against the year's revenue, and the balance placed in suspense pending creation of a renewals fund as above. An application is before the Board of Trade for an extension of time for the completion of the Hanley to Bucknall line and a portion of the Longton-Blythe Bridge route, the directors being of opinion that the development in the district has not yet been sufficiently great to justify their immediate construction. Owing to the practically total absence of development on the remaining portion of the Blythe Bridge route and on the Newcastle to Trent Vale route, the directors have applied for powers to abandon their construction, and are awaiting the decision of the Board of Trade in the matter.

	Year ended Dec. 31st, 1905.	Year ended Dec. 31st, 1906.
Miles open—Route miles	31·68	31·68
Single line	23·55	23·55
Double line	8·13	8·13
Passengers carried	17,424,667	19,148,325
Average traffic receipts per passenger	1·24d.	1·19d.
Average expenditure per passenger	·74d.	·74d.
Proportion of expenses to receipts	60 %	62 %
Cars in stock	105	110

Indo-European Telegraph Co., Ltd.

The directors' report for the year 1906 says that the lines of the company continue to work efficiently, and the direct Wheatstone working enables constantly increasing traffics to be dealt with without additional delay and with a minimum of errors. The revenue from message account and other sources, as shown in the revenue account, amounts to £124,610, as compared with £129,762 for 1905, showing a decrease of £5,152. The expenses are, on commercial and general account, £46,675, and on maintenance account £26,969, making a total of £73,644, as against £70,793 for 1905, showing an increase of £2,851. The revenue account therefore shows a balance of £50,967, which is carried to profit and loss account, 1906, and after deduction of income-tax paid is reduced to £47,178. Adding £16,699 brought forward, and £3,838 in respect of outstanding traffic receipts kept as an open balance in the accounts for 1905, which the directors have now decided to bring into profit and loss, there is a total of £67,715. They have also decided to provide the sum of £16,240, which is necessary to meet the further depreciation to date, which has unfortunately taken place upon the company's investments. Deducting this sum and the interim dividend of £10,625, already paid, there remains a balance available for distribution of £40,850. The directors now propose to declare a dividend for the six months ending December 31st, 1906, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax, carrying forward £8,975 to 1907. They do not consider it necessary to re-invest the interest accrued during 1906 upon the unappropriated investments and upon the deposit of Russian Government Rente, and therefore propose to make a special distribution to the shareholders from these sources of £12,750, equivalent to 15s. per share, free of income-tax. The directors report with great regret the death in May last of Mr. W. S. Andrews, for upwards of 34 years connected with the company as manager, managing director and director.

The meeting is to be held on Monday, April 29th.

British Electric Transformer Co., Limited.

The fourth ordinary general meeting of this company was held on Friday last at the Cannon Street Hotel, Mr. E. Phillips presiding.

In moving the adoption of the report (see Electrical Review, April 22nd, page 610) the Chairman said that the shares were now all fully-paid up. The forfeited shares stood at the same figure as in the previous year. The debts owing by the company were £4,000 less, owing to the fact that they had bought sparingly in consequence of the high price of raw materials and their paying for goods in ready cash, thus getting the benefit of discounts. The depreciation reserve fund had been increased by £1,500 in accordance with a resolution passed at the last meeting. They now had 100 patents, as against four when the company was first started. During the year they had been very successful with the series gear patent, which was taken out by Mr. George Berry. They had been negotiating for the purchase of their rights in other countries, and the directors hoped the efforts of Mr. Berry would prove successful. The company had been awarded the gold medal at the Milano Exhibition for the series gear patent, and the announcement of this award had brought them increased business. The goodwill remained the same, and preliminary expenses had been reduced by £1,500. The land, buildings, &c., had increased in value by £424. They had introduced during the year electric current for lighting the works, in place of gas, and it was found much more effective. Their property at Hayes had greatly increased, and was estimated to be three times the value of the original amount paid for it, and the property was likely to still further increase during the next few years. Debts owing to the company were less than usual, which was owing to the fact that they had had to write off a large sum as irrecoverable. Turning to the profit and loss account, the net profit for the year, after writing off the capitalised value of the patents sold and expenses incurred in obtaining those patents, stood at very nearly the same figure as in 1905. The directors' fees were £88 less. The stock of materials were somewhat larger. They had lost a considerable amount due to the depreciation of their investments. As the shareholders were aware the company in some instances had to accept part-payment for goods supplied to companies in shares, and owing to the failure of a particular company they had lost very considerably. They had thought it wise to write down very drastically the value of their shares received in payment of certain contracts. That policy had left them with a loss to carry forward of £3,988. With regard to the present position of the company, he was of opinion that their business was in a very healthy condition. A great many new contracts had been entered into, including those for the Admiralty, an important railway company, and two corporations in British dependencies. All those contracts would probably lead to repeat orders. Competition had been, and was still keen, but they had managed to hold their own.

Mr. A. F. Bird, in seconding the motion, remarked that he knew the report was not very bright, but he was a sufferer in common with the other shareholders, being, as he was, the largest shareholder, both in preference and ordinary shares.

A lengthy discussion ensued, in which the policy of the board was severely criticised.

Mr. Bird said he could not understand how a body of business men got into such a mess as to lose £20,000 in a year.

Mr. Walton remarked that he saw a company had been started under the name of the Berry Construction Co., and he should like to know whether that company was an opposition company, and if the patents used by the Berry Co. were the property of the Transformer Co. He thought that during the present year they ought to see that they had business men to run the company. They had no right to find themselves in that position. The company had been utterly reckless.

After further discussion, Mr. Berry said that the company bearing his name was started by him to act as a sort of feeder to the Transformer Co. A contract had been entered into between the two companies, whereby the Transformer Co. were to construct the necessary transformers should they be required. The patents of the Construction Co. did not belong to the British Co.

The Chairman, in reply to the questions of shareholders, said that the companies responsible for the depreciation in investments, were the South Wales Power Co., the Durham County Co., and the British Power Co. The value of their patents was £28,000, as against £25,000 for the four they possessed when the company first started. With regard to the change of management, Mr. George Berry had been connected with the company since 1898, and they had every confidence in him. With reference to the validity of Mr. Berry starting another company, the question had been submitted to counsel on both sides, but they had not agreed. The stock of materials was stated at cost price.

The report was then adopted, and a Committee of shareholders appointed to confer with the directors as to the future of the company.

Calcutta Tramways Co., Ltd.

The directors' report for the year 1906 shows gross traffic receipts £158,857; working expenditure under all heads, £86,918; and a revenue balance, after crediting sundry receipts, of £72,678. Against this have been debited debenture interest, £15,750; interim dividend, £18,375; interest on new shares, £8,152; interest on preference shares, £3,750; making a total of £46,027; leaving a balance of £26,650. To this is added £701 brought forward, and interest earned on monies in hand £2,096, making the total sum now to be dealt with £29,448, from which the directors recommend a final dividend of 4s. 6d. per share, which needs £23,625. Of the balance, £5,823, they propose to allocate to the depreciation fund £5,000, and to carry forward £823. In June last a new creation of capital was made in the shape of 5 per cent. preference shares, and of these 30,000 of the face value of £150,000 were issued, carrying interest from July 1st. This had needed £3,750 to be provided from revenue. It was anticipated, and with good reason, that some of the extensions which, when completed, will add upwards of 50 per cent. to the existing street mileage, and for which this new capital was raised, would have been in operation, and would have contributed towards the earnings during the year, but this anticipation has not been fulfilled, and although the new plant and machinery have undoubtedly contributed towards the large increase which has taken place in the receipts, their full value has yet to be realised, and the increase in the ratio of operating expenses to receipts is due to the imperfect use to which the additional costly plant has been put. It has been possible to successfully develop the existing lines, but only by the capital outlay which has been made, so that the preparations have been, in spite of the delay in the actual opening of the new lines, justified in part, and will, no doubt, become more beneficial as soon as new lengths of line are open. The directors consider the results of last year the more

satisfactory, as during the first half of the year great scarcity prevailed in Calcutta, and the price of food grain rose to a very high figure, so that the large additional service of cars did not at first prove remunerative, but this was made up during the last half of the year, and very large receipts were realised during the cold weather months, which it would have been impossible to collect had not timely provision been made. The directors recorded with the greatest regret the losses sustained by the company by the deaths of valued members of the administrative and executive staff. In August they lost the assistance of Mr. Sanderson, who had been with the company since its inception and had helped to steer it through the difficult periods of its existence; and in January the sudden death occurred of the general manager, Mr. Martyn Wells, to whose energy, tact and ability much of the present success of the company was due. Mr. J. G. B. Stone had been appointed a director in the place of Mr. Sanderson.

	1906.	1905.
Miles of tramway..	23	23
Cars in stock at December, 1906, 200 motor and 200 trailer..	400	354
Passengers carried (*i.e.*, tickets issued)	26,113,093	23,831,764
Train mileage run	4,293,721	3,790,730
Earnings per train-mile..	8·88d.	9·20d.
Expenses per train-mile	4·85d.	4·79d.
Average fare per passenger	1·46d.	1·46d.

N.B.—In the above accounts the rate of exchange is taken at 1s. 4d. per rupee.

The ordinary general meeting was held on Tuesday at 1, Queen Victoria Street, Mr. E. C. Morgan in the chair.

In proposing the adoption of the report, the Chairman said that at the first glance the figures did not appear to be wholly satisfactory, as they indicated that the expenses had increased in a greater ratio than the receipts. He must, therefore, give some explanation which, he thought, would prove that the actual results were distinctly satisfactory. They were aware that, in anticipation of the extensions before them, it was necessary that they should make timely preparations for dealing with them as soon as they came into operation, and for this purpose they made large additions to their capital to provide the needful plant and machinery. Of the amount so raised a large proportion had been actually expended before the commencement of the year now under review in the installation of new buildings and sub-stations, boilers, generators, cars, permanent way and high-tension cables. The delays which had taken place in getting the new lines into operation, and which, he was sorry to say, still existed, although they seemed now in a position to get forward more rapidly, rendered it necessary to cast about for a means of getting some return for their further capital outlay, and this could only be done by running a greater mileage on their existing system, which, although it could not be expected to give immediately such good results as had hitherto been obtained, would, at all events, give something to lighten the heavy charges running for interest on the new capital. With this object in view, they determined to increase their service by some 10,000 miles per week, which their additional cars and power enabled them to do, although they were aware that, at first, such an increase would tend to increase the ratio of their operating costs. The result of their increased mileage during the first half of the year was worse than they could reasonably have anticipated under normal conditions, due to the fact that a partial failure of the crops in 1905 rendered the cost of food very high, and prevented the poorer classes of riders from availing themselves of their cars. For the first six months of the year, therefore, their ratio of expenditure showed a large increase, but the net earnings still left a considerable increase over the amount they would have gained had they adhered to the smaller mileage of the previous year. After the turn of the year, however, when the new crops began to arrive, and prices of food grains to fall, traffics improved, and continued to do so until the end of the year, when they had got their improved system into such good working order that they were able to cope with the very heavy traffics which then developed, and were able to collect during the Christmas week the very large amount of upwards of £5,000, which would have been a physical impossibility had it not been for their timely preparations. The improvement during the last half of the year was so considerable that they were able to bring down their cost per train-mile very closely to the figure of that during 1905, and their receipts per train-mile to within ·32 of that during 1905 on an increased mileage of 500,000 miles. The benefits arising from their forward policy had been even more apparent during the current year, when they had increased their gross receipts by upwards of £6,500 without practically any increase in the mileage or cost of running. There had been a very large increase in power expenses, which was mainly owing to the additional cost of fuel. This was due to three causes—first, the increased price they had had to pay for coal; second, the larger amount of coal needed to provide the increased power which had been augmented by the use of their new alternating-current plant; and third, by the defects in the condensing plant. The first two causes were more or less beyond their control, but the third was to some extent preventible, and steps were being taken which would result in considerable savings. There had been a large increase in operation wages and salaries, which was due to the staffs which had to be maintained at the sub-stations and batteries, which did not figure in the last accounts, but which were absolutely necessary for effective and economical working. In the expenditure on the electrical equipment of cars, a large increase was due to an extraordinary expenditure caused by the burning out of 57 armatures in consequence of floods. The Calcutta streets were liable to go under water on very slight provocation, and although they took the greatest precaution to get their cars out of reach of the flood water, they were not always successful. As regarded the extensions, a short length of line along Lower Circular Road, about ¾ mile, had been opened for traffic since the issue of the report. It was not a line from which they anticipated much increase to their traffic, but it would greatly facilitate their working, and would, he trusted, enable them to reduce their expenditure. Another short length of about a mile along the Diamond Harbour Road was practically complete, and might be opened at any time, but the full line, of which this was a part, would be delayed by the completion of some bridges which needed strengthening, and which were being dealt with by the Government. In Howrah, the lines were for the most part laid, but there were gaps due to road widenings being needed in certain points, and this was a matter which rested in the hands of the municipality, but it was hoped that before the end of the year they might be running in this district. They had also made a step forward with the Barnagore extension, where questions as to the concession had been raised which were now settled, and they were only waiting the necessary authority from the Government to get forward with the work.

Sir Henry Kimber, Bart., M.P., seconded the motion, and the report was adopted.

Oldham, Ashton and Hyde Electric Tramway Co., Ltd.

The tenth ordinary general meeting of the shareholders of this company was held on Tuesday at Hamilton House, Victoria Embankment, Mr. Emile Garcke presiding.

In proposing the adoption of the report, the Chairman said he thought they would recognise that the position of the company was satisfactory. It was a pleasure to him to be able to say that the improvement which he foreshadowed in his remarks last year had been in a very large measure realised. They had carried over six million passengers, which was about 200,000 more than in the preceding year. The average receipts per passenger were slightly up, and the expenses were a little less. The most satisfactory feature was that the proportion of expenses to receipts had been reduced from 72·4 per cent. to 67·8. The total revenue for the year amounted to £31,609—about £1,500 more than in the preceding 12 months, and the expenses were a little less, so that the profit for the year was £7,800, as against £6,200 in 1905. They proposed to apply that profit by placing £2,000 to depreciation and reserve fund, as against £750 last year. He thought all the shareholders would concur with the directors that the larger provision they proposed to make this year was a prudent course to pursue. They proposed to pay the 5 per cent. for the year on the preference shares and 6 per cent. on the ordinary shares, the same as in the preceding year, and to carry forward £494, as against £176 brought into the account. The result of the year's working was even a little better than the figures showed, because they had charged against last year's revenue account £300 remuneration to the directors, which was withheld in previous years. The improvement was due to better trade in the district and the improved agreements they had been able to make in regard to running powers. They had also made an improved agreement with regard to the supply of electrical energy. They had spent £483 on capital account during the year, and the permanent-way, the overhead equipment, rolling stock, buildings, &c., had all been kept in a good state of repair. At the moment trade was good in the district, and there was every indication that the accounts for the current year would be quite as good as, if not better than, those now presented.

Mr. Robert Whitaker seconded the motion, and the report was adopted.

City of Buenos Ayres Tramways Co., Ltd.—This company held a meeting at Winchester House on 10th inst., at which the liquidators submitted their final report upon the winding-up.

Colombo Electric Tramways and Lighting Co., Ltd.—The directors have transferred £5,523 to the reserve and renewal fund, and they propose a dividend of 2½ per cent., carrying forward £872.

National Electric Construction Co., Ltd.—A dividend of 10 per cent. per annum is recommended.

Telephone Co. of Egypt, Ltd.—The directors have declared a further dividend of 3½ per cent. on the deferred shares, making 7½ per cent. for the year 1906; £5,000 is placed to reserve, and £2,082 is carried forward.

Babcock & Wilcox, Ltd.—According to the *Times*, the directors recommend a final dividend and bonus of 2s 4½d. per share on the ordinary shares, making with the interim dividend a total distribution of 20 per cent. for 1906.

Primitiva Gas and Electric Lighting of Buenos Ayres, Ltd.—The accounts for 1906, including a balance of £16,986 brought forward, show a total of £130,474; and after deducting debenture interest, preference share dividends, and the interim dividend on the ordinary shares, and placing to reserve £14,736, a final dividend of 4s. 6d. is recommended on the ordinary shares, making 7 per cent. for the year; £16,612 is carried forward.

British Columbia Electric Railway Co., Ltd.—An interim dividend on the deferred ordinary stock for the half year to December 31st at the rate of 7 per cent. per annum, less income-tax, is payable on April 30th.

MARKET QUOTATIONS.

Wednesday, April 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	82/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£15	..
a Copper Sulphate	per ton	£22 10	£1 dec.
a Lead, Nitrate	per ton	£34 10	..
a ,, White Sugar	per ton	£35	..
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	220/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£200	..
b ,, Wire, in ton lots	per ton	£220	..
b ,, Sheet, in ton lots	per ton	£210	..
p Babbitt's metal ingots	per ton	£61 to £203	..
c Brass (rolled metal 2" to 12") basis	per lb.	11d.	..
c ,, Tube (brazed)	per lb.	1/0½	..
c ,, ,, (solid drawn)	per lb.	11½d.	..
c ,, Wire, basis	per lb.	10½d.	..
c Copper Tubes (brazed)	per lb.	1/2	½d. dec.
c ,, ,, (solid drawn)	per lb.	1/2½	½d. dec.
g Copper Bars (best selected)	per ton	£118	..
g Copper Sheet	per ton	£116	£2 dec.
g ,, Rod	per ton	£118	..
e ,, (Electrolytic) Bars	per ton	£117	£1 dec.
e ,, ,, Sheets	per ton	£125	..
e ,, ,, Rod	per ton	£123	..
,, ,, H.C. Wire	per lb.	1/2½	..
f Ebonite Rod	per lb.	8/8	..
f ,, Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/8	..
h Gutta-percha, fine	per lb.	6/- to 7/-	..
h India-rubber, Para fine	per lb.	4/11½	¾d. inc.
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	55/6½	1/10 inc.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£20 7 6 to £20 10	10/- inc.
g ,, ,, Sheet	per ton	£21 5 to £21 10	..
m Manganin Wire No. 28	per lb.	8/	..
g Mercury	per bot.	£7	..
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/4½ to 1/6½	..
p ,, rolled bars & rods	per lb.	1/5½ to 1/6½	..
p ,, ,, strip & sheet	per lb.	1/6 to 1/10	..
o Platinum	per oz.	140/-	10/- dec.
e Silicium Bronze Wire	per lb.	1/3½	½d. dec.
r Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
,, ,, in bars		£15 to £40	..
g Tin, Block (English)	per ton	£190 to £191	£4 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals—			..
"White Ant" brand	per ton	£61 to £85	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£30 10	5/- dec.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n F. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

City and South London Railway Co.—At a special general meeting held at the offices on Tuesday, a resolution was passed giving the board a free hand to issue debentures, preference or ordinary stock, or some of each as found advisable. The chairman mentioned that the condition of the Money Market had been very unfavourable for raising capital during the period of the construction of their extension to Euston, and particularly so during the last six months. They wanted to have at their disposal all possible means of getting the sum required, so as to raise it on the most advantageous terms obtainable. If nothing unforeseen occurred they would open the extension on May 11th.

STOCKS AND SHARES.

Tuesday Evening.

More activity in Stock Exchange markets has resulted from the increased confidence which developed after the turn of the quarter. The fall in the Bank Rate, too, exercised a wholesome influence upon prices, gratitude for the reduction being truly in this case a lively sense of further favours to come. Money that has lain at the banks upon deposit for months past, is seeking Stock Exchange channels of investment now that Lombard Street gives indications of pronounced ease. The City is more cheerful, and this sentiment has a marked effect upon prices in many directions—most notably, so far as electrical issues are concerned, in the case of Central London Railway stocks. The directors' experiments with the tickets last week, to which we alluded, have drawn public attention to the very low prices to which the Company's Ordinary and Deferred stocks have shrunk. With the prospect of graduated fares rehabilitating the traffic receipts, the revived appetite for "bargains" sent buyers into the market for Twopenny Tube stocks, and the Ordinary has risen 7 points to 76, the Deferred 5 to 57½. City and South London is also a point harder at 42, but Great Northern and City Preferred continue to dwindle, and the price has fallen to 55s.

Metropolitans rose again to 48½, and even Districts were slightly better at 14⅛. There has been no further fall in Underground Electric Notes after the slump of 7½ last week.

Electricity supply descriptions are a firmer market than they have been for some time past. The recent pessimists have changed sides, declare that prices were unduly depressed, call attention to the good returns obtainable from many of the shares in the Supply List, and are doing what they can to make the best of things. A slender inquiry for the best-known shares is reported, and a healthy sign is the improvement in some of the Debenture stocks, such as County of London, Notting Hill, and Smithfield Markets. But it is more healthy still to see Charing Cross shares advanced to 3⅛, Chelseas to 4½, Citys to 10½—a rise of 15s.—Countys to 8¼, the Preference to 11. With reference to the first-named, it may be pointed out that Charing Cross City Undertaking 4½ per cent. Preference shares stand at 4 middle, at which price the yield is fully 5½ per cent. on the money. Hove shares were quoted *ex* 5s. dividend last week, and Folkestones were *ex* 3s. 6d., the deductions being roughly represented in the prices.

The marking of Anglo-Argentine Tramways Ordinary shares *ex* 4s. dividend is reflected in the fall of $\frac{3}{16}$ to $7\frac{9}{16}$. Calcutta Trams have recovered from their recent weakness, and Metropolitan Tramways Preferred are $\frac{1}{16}$ firmer at 18s. British Electric Tractions have not failed to benefit by the better conditions of markets as a whole, and the Preference shares rallied ¼ to 7¼, while the First Debenture stock rose 2 points. British Columbia Electric Railway stocks are unaffected by the declaration of a 7 per cent. dividend on the Deferred.

Telegraph varieties have not participated to any noticeable extent in the improved state of financial affairs. There was a little public demand for telegraphs at the commencement of the present Stock Exchange fortnight, but the inquiry quickly flagged, without leaving much mark upon quotations. Direct United States shares have risen a further 5s., to 15¼, upon the good report, but the Anglo-American group, allowing for dividend deductions, is almost colourless. The Deferred, after hardening to 22½, fell away to 22. Eastern Extensions are flat at 13½, a fall of ⅜, and Great Northerns are £1 lower at 36. There has been heavy forced selling in the case of "China" shares, while the drop in Great Northerns is due to the reduction of 8s. in the dividend. Changes in the prior-charge securities are rather downward on balance.

National Telephone Preferred at 108 has hardened a little, and United River Plate Telephone Preference at 5¼ recovered half the fall of a week ago. Chili Telephones remain at 7. The Miscellaneous list is featureless, and the principal change is a further 5s. rise, making 15s. during this month, in Callender's Cable shares, which now stand at 11½. Crompton Debenture is less firm. Bruce Peebles Preference declined to 4½, *ex* the 3s. dividend, but Willans and Robinson Ordinary hardened to 30s., the Preference at 4 showing no alteration. The Babcock and Wilcox report is regarded with satisfaction, because the slight decline in profits is of little account, coming as it does upon the top of such excellent figures a year ago.

Bell's Asbestos Co., Ltd.—The report for 1906 shows a net profit of £60,901, plus £6,578 brought forward. The directors recommend a dividend at the rate of 12½ per cent. per annum and a bonus of 2½ per cent., free of income-tax, and place to reserve £40,000, carrying forward £9,480. The trade of the year was good, and profits showed an appreciable increase.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations April 9th.	Closing Quotations April 16th.	Business done week ended April 16th. 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil		8 — 8¼	8 — 8¼	..	..	..	Nil
149 600	Do. do. 5 % Debs., Nos. 1 to 1,256 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	61s.	2s%	3½%	3½%	61 — 63	60 — 63	62½	..	— ½	6 3 0
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5⅛%	6 %	6 %	106 —107	105 —106	107½	105½	—1	5 13 2
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	½%	1¾%	21⅞ - 22	21⅞ - 22⅛	22 1/16	21⅝	+ ⅛	7 18 10
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	.. ..	..	5 %	..	99 —101	99 —101	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6⅞— 7⅛	6⅞— 7⅛	..	..	..	5 10 4
2,097,600	Commercial Cable Stng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	93¼— 95⅛	93 — 95 xd	94	93½	..	4 4 3
15,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	8½— 8⅝	8½— 8⅝	8 1/16	..	..	5 14 3
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	16½— 17½	16½— 17⅝	..	..	..	5 14 3
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	9⅛— 9⅜	8⅝— 8⅞ xd	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	10	10 %	10 %	10 %	10 %	8⅝— 9⅛	8⅝— 9⅛ xd	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
68,710	Direct United States Cable	20	8 %	8%	4½%	..	14⅜— 15⅛	15 — 15⅛	15⅛	15 1/16	+ ⅛	5 16 2
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	137 —142	137 —142	140½	139½	..	4 18 7
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	..	87 — 89	87 — 89	88⅝	..	..	3 18 8
1,895,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	..	105 —108	106 —108	107⅜	..	+ ⅛	3 14 1
800,000	Eastern Extension, Australasia, and China Tels.	10	7 %	7 %	7 %	..	13⅜— 14⅛	13⅛— 13⅜	13 1/16	13⅛	— ⅛	5 1 10
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	105 —107	106¼	..	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —101	98 —101	..	..	— ½	3 19 8
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
781,127	Globe Telegraph and Trust	10	5½%	5⅝%	5¾%	..	10⅜— 10⅞	10⅛— 11	10 1/16	10⅛	..	5 0 0
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	13½ — 14½	13⅝— 14½	14 1/16	13⅝	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	44 %	24%	20 %	36 — 38	5 — 37	..	..	—1	5 6 8
33,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,500, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	58 — 60	58 — 60	59⅜	58½	..	5 8 4
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞— ⅞	⅞— ⅞	16/9	16/3	..	Nil
72,650	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	..	1 1/16 — 1 1/16	1 1/16 - 1 1/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 3 11
2,225 000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ —108½	107½ —109½	109	108	+1	5 9 7
2,225 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	104 —106	104 —106	105¼	104½	..	4 14 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13	12⅛	..	..	4 12 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 7/16	5⅜	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	96 — 98	97	..	..	3 11 5
1,689,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101	100½	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	6½%	7⅜%	7 %	1 1/16 — 1 7/8	1 1/16 — 1 7/8	28/-	27/3	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 16 0
100,000	Do. do. do. 4% Red. Deb. Stock	100	.. ..	..	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	99 —102	97 —101	..	..	—2	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7 — 8	6⅞	6 1/16	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	.. ..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
8,167	Submarine Cables Trust	Certs	6 %	6 %	6 %	6 %	126 —129	125 —128	..	..	—1	4 13 9
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅜— 7⅛	6⅜— 7⅛	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	4⅜— 4⅝	5 — 5⅛	..	..	+ ⅛	4 15 3
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 3
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	..	10 — 10½	10 — 10⅜	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ - 14⅛	13 1/8	13⅜	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —104	101 —104	102⅜	102⅛	..	3 16 11
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅛— ⅛	⅛— ⅛	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	..	7⅛ — 7⅜	7⅛ — 8	7⅜	..	+ ⅛	6 5 0
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	5½ — 6½	6 — 7	6½	..	+ ½	Nil
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,600 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0

‡ Including arrears

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007		..	8 %	8 %	8 %	7⅛— 7⅞	7 1/16 — 7 1/16 xd	7⅞	7 1/16	..	5 2 5
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅛%	5⅛%	5 1/16 — 5 1/16	5 1/16 — 5 1/16	5⅞	5 1/16	..	4 12 8
266,800	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	132 —135	132 — 135	..	..	..	4 8 11
225,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	105	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	17 %	20 %	20 %	0 %	3⅞— 4⅛	3⅞— 4⅛	80/-	79/3	..	4 14 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	3 15 7
85,000	British Aluminium, Ord., 2,001 to 40,000	5	.. ..	7 %	7 %	..	5⅝— 5⅞	5⅝— 5⅞	5⅞	..	..	6 1 9
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	..	5⅞— 6⅛	6⅛— 6⅜	6	..	..	5 12 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	6⅛— 6⅜	5⅛— 6⅜	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	.. ..	4 %	4 %	..	4 — 4⅛	4 — 4⅛	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	101 —105	101 —105	..	..	..	4 15 3
300,000	Do. do. 5% % Loch Leven Debs. ..	100	.. ..	..	..	5⅛%	98 —101	98 —101	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	126 —130	126 —130	129	..	..	4 12 4
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	105 —110	105 —110	109¼	109	..	4 10 11
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	103 —107	103 —107	..	..	..	4 13 6
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	99 —101 xd	..	..	..	4 8 3
200,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	4 9 1
189,301	British Electric Traction	10	6 %	6 %	3 %	..	5⅜— 5⅝	5⅜— 5⅝	68/9	62/6	..	8 5 6
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	6⅞— 7⅛	7 — 7⅛	7⅛	7 1/16	+ ⅛	8 0 0
1,448,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	98 —103	101 —105	103⅜	99¼	+2½	4 1 3
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	.. ..	4½%	4½%	..	84 — 86	83 — 86	8 3/4	..	..	5 4 8
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6⅜— 7	6⅜— 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞— 6⅛	5⅞— 6⅛	..	..	..	4 16 0
600,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
219,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	92 — 96	94 — 98	..	..	+2	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
1 016,258	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	65 — 69	65 — 69	..	..	..	5 15 11
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅛— ¼	⅛— ¼	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	24%	..	⅝— ⅞	⅝— ⅞	..	..	..	5 14 3
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	6 17 2
125,000‡	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	89 — 92	89 — 92	89⅜	..	..	4 17 10
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	73 — 74	73 — 74	75	..	..	5 15 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	..	3¾— 4	3¾— 4	71/3	..	..	3 15 0
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	..	5 — 5⅛	5 — 5⅛	..	..	..	5 11 3
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	..	4⅞— 5⅛	4⅞— 5⅛	97/6	..	..	5 12 11
18,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
105,000	Calcutta Trams., 1 to 105,000	5	6 %	8 %	8 %	8 %	7⅛— 8⅛	8 — 8⅛	8⅛	..	+ ⅛	4 14 1
82,610	Do. 105,001 to 187,610	5	.. ..	..	8 %	8 %	7⅞— 8	7⅞— 8⅛	..	..	+ ⅛	4 17 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	.. ..	..	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 6 11
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
85,000	Callender's Cable Construction shares	5	12½%	12½%	15%	..	10⅛— 11⅛	10⅜— 11⅜	10⅜	..	+ ⅛	6 7 8
40,000	Do. do. 6 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅜— 5⅝	5⅜— 5⅝	5 3/8	5 5/16	..	5 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	7/16 — 9/16	7/16 — 9/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	25/-	..	..	4 11 5
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	68 — 70	75 — 77	74⅜	..	+7	5 3 11
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93⅜	93	..	4 5 4
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	51 — 54	54 — 59	56⅜	55½	+5	6 15 7
1,480,000	City and South London Railway	Stock	2¾%	2¾%	1¾%	2¾%	40 — 43	41 — 43	42⅛	41⅛	+1	4 14 10
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	2½%	2½%	..	1⅛ — 2⅛	1⅛ — 2⅛	3 1/4	..	..	3 10 2
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	97 — 99	96 — 99	..	..	— ½	5 1 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(continued).

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Mar. 25th.	Closing Quotations April 16th.	Business done week ended April 16th, 1907.		Rise + or Fall—	Present Yield per cent.
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1½ — 1¾	1½ — 1¾	..	..	..	6 13 4
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	..	1 31/32 — 1 32/32	1 31/32 — 1 32/32 xd	..	..	..	4 19 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	104	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½%	6 %	6 %	..	14½ — 15½	14½ — 15½	..	..	..	3 18 8
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13¾ — 14¾	13¾ — 14¾	..	..	..	3 18 8
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	2½%	4½%	..	1⅛ — 1⅜	1⅛ — 1⅜	21/10½	..	..	9 3 9
17,189	Do. "A" shares, 01—017,189	5	Nil	2½%	4½%	..	2¼ — 2¾	2¼ — 2¾	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	88 — 92 xd	..	..	— ½	5 8 8
112,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1½ — 2	1½ — 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 — 84	81 — 84	..	..	..	4 15 8
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8⅝ — 9⅜	8⅝ — 9⅜	..	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95 xd	..	..	..	4 4 3
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2⅜ — 3	2⅜ — 3	..	..	— ⅛	11 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	12 — 13	12 — 13	12½	..	..	5 15 5
300,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5⅝	5⅛ — 5⅝	5 7/16	..	..	3 15 7
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	107	..	..	4 2 7
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ — 16½	15½ — 16½	..	..	..	6 3 1
87,500	†Liverpool Overhead Railway, Ord.	10	1⅜%	1½%	Nil	Nil	1⅜ — 1½	1⅜ — 1½	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid ..	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 8 2
600,070	London United Trams (1901), 1 to 50,007 ..	10	8 %	6 %	8 %	8 %	7 — 8	7 — 8	..	..	..	3 15 6
899,280	Do. do. 50,008 to 100,000	10	8 %	6 %	8 %	8 %	7 — 7¾	7 — 7¾	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	10	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	..	..	..	5 14 3
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85 — 90	85 — 90	..	..	..	4 8 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	7/16 — 9/16	7/16 — 9/16	..	..	..	Nil
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	29/32 — 31/32	29/32 — 31/32	18/-	17/-	+ 1/16	5 3 11
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 0
30,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	6 10 8
25,500	Potteries E. Tro.	1	5 %	5 %	4 %	..	3/16 — 5/16	3/16 — 5/16	..	..	..	5 6 8
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	3/16 — 5/16	3/16 — 5/16	13/3	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	98½ —101½	98½ —101½	..	..	..	4 8 8
37,850	Telegraph Construction and Maintenance ..	12	20 %	15 %	15 %	15 %	29 — 31	29 — 31	30½	30½	..	5 15 5
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	..	5 %	5 %	5 %	76 — 79	76 — 79	..	..	..	6 6 7
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	8 %	Nil	Nil	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3⅜ — 4½	3⅜ — 4½	82/6	27/6	+ ½	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 82	77 — 82	77	79/4½	..	Nil
										..	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅞ — 5⅛	4⅞ — 5⅛ xd	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7⅛ — 8⅛	7⅛ — 8⅛	7⅛	..	..	6 1 3
10,502	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..	4 7 6
836,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	8 17 8
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	8 %	5 %	2⅜ — 3⅜	3 — 4	67/6	..	+ ½	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅜ — 4⅛	3⅜ — 4	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3⅜ — 4¼	3⅜ — 4¼	82/6	77/-	+ ½	4 14 9
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9½ — 10¼	10 — 11	10½	9⅝	+ ½	5 9 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11 — 12	11 — 12	..	..	..	5 0 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	122 —125	..	..	+1	4 0 0
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	98⅝	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	4	4 %	£8 7 0	4 %	4 %	3⅞ — 4	3⅞ — 4 xd	..	..	..	4 0 0
80,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	4⅛ — 5	4⅛ — 5 xd	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	7⅞ — 8⅛	8 — 8¼	..	..	+ ⅛	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 — 11	10⅜ — 11⅛	..	..	+ ⅛	5 4 4
450,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	106 —109	..	..	+1	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	1⅛ — 2⅛	1⅛ — 2⅛	30/-	..	..	8 0 0
80,000	Do. do. 6 % Cum. Pref... ..	5	6 %	6 %	6 %	..	3 — 4	3 — 4	..	..	..	7 10 0
850,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	88 — 91	88 — 91	..	..	..	4 18 11
10,000	Folkestone, 1 to 10,000	5	5⅞%	5⅞%	5⅞%	5⅞%	6⅛ — 6⅜	4⅞ — 6⅛ xd	..	..	..	5 2 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 6⅛	5 — 6⅛ xd	..	..	..	4 15 3
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	99	..	..	4 10 0
18,000	Hove, 1 to 18,000	5	8½%	8½%	9 %	9 %	7⅞ — 7⅞	7 — 7⅛	..	..	— ⅛	6 0 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	12%	12 %	10 %	10 %	8⅞ — 9⅛	8⅞ — 9⅛	..	..	..	6 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	8	Nil	8 %	4 %	4 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 14 3
874,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	5 18 6
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5⅛	4⅝ — 5⅛	5⅛	5 3/32	..	4 3 9
220,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —110	106 —110	..	..	..	4 1 10
260,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	10 — 93	10 — 93	..	..	..	3 15 3
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7⅛ — 7⅜	7⅛ — 7⅜ xd	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 6	5 — 6 xd	..	..	..	4 3 4
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½ %	7½ %	12 — 13	12 — 13	..	..	..	5 15 5
64,000	Do. do. 4 % 1st Mort.Deb... ..	100	4 %	4 %	4 %	4 %	95 — 98	96 — 99	..	..	+1	4 0 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6¾%	7 %	7 %	7 %	5⅞ — 6⅛	5⅞ — 6⅛	..	..	..	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	12½%	10 %	7⅞ — 8⅛	7⅞ — 8⅛	8⅛	..	..	5 17 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 13 4
160,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	93 — 95	93 — 95	..	..	..	3 13 8
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1¼ — 1½	1¼ — 2¼	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	72 — 76	73 — 77	..	..	+1	5 3 11
66,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	3 %	2⅛ — 2⅜	2⅛ — 2⅜ xd	20/-	..	..	5 9 1
120,000	South Met. Elec. Lt. & Power, Ord..	1	Nil	Nil	2½ %	2½ %	5/16 — 7/16	5/16 — 7/16	..	..	..	3 6 8
117,968	Do. do. 7 % Pref... ..	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103 xd	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	2 — 3	2 — 3 xd	..	..	..	8 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	3 — 4	3 — 4	..	..	..	6 5 0
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
110,000	Westminster Electric Supply, Ord.	5	15½%	14 %	13 %	12 %	9 — 10	9 — 10	9½	9 5/16	..	6 0 0
81,279	Do do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5⅛ — 5⅜	5⅛ — 5⅜	5 3/32	..	..	3 18 3
	(Originally 5%—Red. to 4½ % from 31st Dec., 1906.											

Shares not officially quoted:—Mackay Companies, ord., 70—72 — 1½. Pref. 70—72 — 1½.
† Unless otherwise stated all shares are fully paid. ‖ Interim dividends.

Bank rate of discount 4½ per cent. April 11th, 1907.

STATION ENGINEERS AND CONTRACTORS.

By G. B. B.

At the present time electricity, as far as regards lighting, is, whilst not actually losing ground, at any rate at something closely resembling a standstill. Whether the advent of the metallic filament lamp will supply the much needed fillip or not is a moot point, but it behoves everyone interested to calmly and impartially review the various factors, which, combined, have resulted in the present lamentable state of affairs. The chief underlying cause is, undoubtedly, the success which electricity attained a few years ago in competition with the old fishtail gas burner, and the older forms of incandescent gas mantles. As an illuminant the 16-c.p. lamp was superior to the naked gas flame, whilst the mantles depreciated so rapidly, and consequently so frequently needed costly renewals, that in spite of their initial superiority in candle-power, the electric lamp much more than held its own. This being the case, electricity rather put on airs, and in consequence those in authority assumed a dignity, which, however it may have suited those who wore it, was not of service to the industry. Station engineers, unbusinesslike to a degree hitherto unattainable in commercial life, rested content, and devoted their attention to the discussion of academic problems, and the formation of mutual admiration societies, apparently imagining that the "golden age" would last for ever. In the meantime, gas engineers were working quietly, but on sound lines, with a view of re-establishing the supremacy of gas, and after a few years of masterly inactivity spent in lulling electrical engineers to sleep, began placing on the market improved mantles and high-pressure burners, and elaborating schemes of hire and hire purchase; began improving gas supply and developing prepayment meters, until, in a comparatively short time, gas lighting has so rapidly come to the front that, as I said before, it is necessary for all who are interested in electrical progress to see what steps can be taken to combat the danger which undoubtedly exists, of electric lighting being relegated to the background.

There are many technical points that require consideration, and at the present time all electrical men are working individually, and it may be said frantically, and in many cases foolishly, to recover their lost position. Here one issues a little scissors and paste monthly of his own, forgetting that its contents have been read many times before, and heedless of the fact that the great technical press are doing the work to which he is applying himself far better than he can ever hope to do. Another devises a series or two of neat little picture postcards, careless of the fact that the great public are not to be wooed into spending much hard-earned money, and incidentally getting what is frequently a worse light, at frequently a higher price, by the blandishments of the pictorial presentment of a lady making tea. A third apparently thinks salvation lies in testing and renewing gratuitously the lamps of the man who can well afford to buy his own. The schemes and devices are legion, and are outside the scope of the present article—some day I may refer to them again—but there is one attitude which has been rarely touched upon, but which has in a great measure contributed to the present lamentable state of affairs, and which, properly dealt with, may prove of great service in assisting to regain lost ground; it would at any rate materially assist in the success of all other schemes and methods. I refer to the attitude of station engineers toward contractors.

I am aware that contractors are a bad lot. They are unrefined in many ways, and they are frequently ill-clothed and ill-washed. They keep their books in fearful manner understandable only by themselves, and they have highly original methods of quoting for work, and according to the Station Engineer, very original ways of carrying out the same. They are ignorant. They know nothing of coulombs, and joules, and so are not electricians. Many of them know nothing about Kelvin sets, and Wheatstone bridges. What they term a "jigger" is good enough for them. They cannot work out the drop in volts along so many decimal points of a mile, when using a conductor of so much conductivity and such and such a sectional area. Some of them even cannot use a slide rule, and are quite at sea with a table of logarithms. They have a habit of forgetting to inform the station man that they have fixed one more 8-c.p. lamp on so-and-so's premises. They go on in their own way, and are too busy to conform to the social rules of the high altitudes of refinement that are the habitual abode of the supply engineer. They are "poor whites!"

In the eyes of the station engineer, they are "no class."

And the sooner the station men get the foregoing ideas out of their heads, the better. The highly superior attitude that they habitually adopt towards the contractor has done harm which it will take years to eradicate, and which has had, unfortunately, a very bad effect in the eyes of the public generally.

The station engineers rather fancied themselves. They were placed in high positions of authority, and they commenced framing rules and regulations which were to be obeyed, and which, whilst modelled on the laws of the Medes and Persians, were intended to be still more binding and unalterable. And, oh! the silly, fatuous rules that they were! We speak of the "grandmotherly legislation" that has hampered our industry, but what of their own regulations? Rules that all lamps must hang in this, that, or the other position—that flexible must or must not be used; that all main switches must be coupled; that no main switches must be coupled; that all switches must have brass covers; that brass-covered switches are not allowed; that fuses are to be fixed against all switches; that no fuses are to be fixed except at a convenient distribution board; that all mains must be run in iron barrel; that iron barrel must on no account be used; that where it is used, it must be earthed; that it must not be earthed; that lead-covered twin cables are not to be run; that keyholders are not permitted; that—but why trouble to record the many stupid regulations that have vexed contractors since the days of tree-wiring? Silly, pompous rules illegally enforced, fees for re-tests illegally claimed; rules and fees that may, for anything I know, be enforced illegally to-day. It is a great question, this attitude, and many a man who had taken up electrical work has been disheartened by the thick-set hedge of central station impertinence, and so driven to selling mantles and installing gas pipes, who, properly treated, might have been of genuine service to the industry.

The question of the wiring business has long been settled. It is said, and has been said for many years, that there is no profit in wiring, and that the only way for electricians to make both ends meet is to sell lamps and fittings. Practically this is correct, and there is little room for wonder. This, that, and the other fancy and expensive way of working is enforced by the station, some faddy and costly distribution board, make of accessories, or main switch is to be used, and at the end of the story an utterly unreliable test is made, frequently by some half-trained assistant; the work is condemned, the station refuses to connect, and the contractor has to pull off switches and ceiling roses, test out leads and mains, whilst all the while the general public is (1) looking askance at electric lighting on account of its complications; (2) condemning the contractor as a shoddy, jerry workman who has been trying to palm off an unsatisfactory job.

I said "unreliable test." When a new job can be tested without having been affected by the weather prior to the test, I will withdraw that remark. A dry day, a wet day, a foggy day, or a frosty day, all these affect the test, and if, as usual, an allowance is made for the weather, that allowance, being a matter of rule of thumb, does not render the test any more reliable.

I am not advocating the abolition of supply tests, but I do say that they should be shorn of their irritating surroundings, and their stringency relaxed, particularly in those cases where the contractor is a man of repute, employs good workmen, uses good material, and exercises a proper supervision. He may be ignorant of such knowledge that the station man possesses, but he probably has a great deal more practical knowledge of wiring that the other will ever have. It is not to his interest to put bad work into a job, when he has an established business, and a reputation to keep up. He is a man of common business honesty, and there seems no likelihood of establishing good relations between him and the supply man, when he is apparently regarded as a criminal lunatic.

What has the contractor done for the station? He came into the field at the beginning, risked his capital, in many cases risked his reputation for sanity; he has canvassed energetically, and given what publicity he could to the undertaking. He has fitted up a showroom, hung boards about the place: "Electric lighting by so-and-so," and worked hard to make the station a success, and his reward has been poor. He has received treatment that he himself would not have meted out to any person with whom he had business relations. It is small wonder that in many cases he has found it to his commercial advantage to push the sale of gas mantles rather than of electric lamps.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Multiple Spring Trolley.

Messrs. Brecknell, Munro & Rogers, Ltd., of Thrissell Street, Bristol, have introduced a new multiple spring trolley which we show in the accompanying outline drawing. It is a bow collector for use on single-deck cars. The feature of this type of collector lies in the flexible mounting of the holder which carries the bow. It will be observed that this holder is controlled by four springs on either side, which are so mounted that while the springs on one side are in operation, those upon the other are simply carried idle. These springs when in operation maintain the collector bow and frame at an angle of about 10 degrees with the vertical at

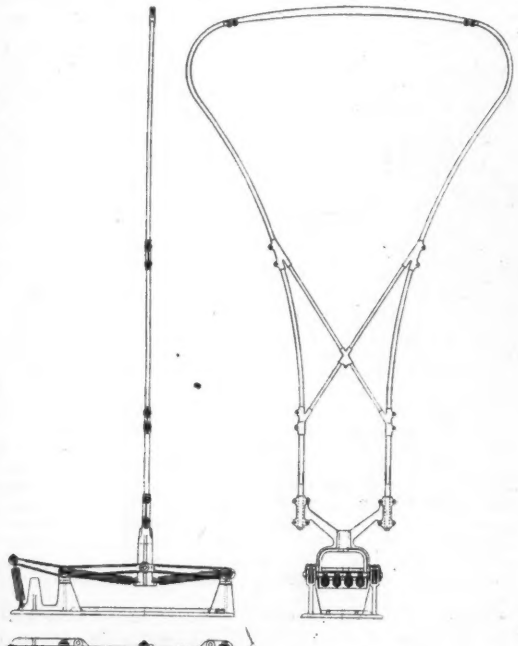


Fig. 1.—Multiple Spring Bow Collector (Uninsulated) with Aluminium Bow Contact.

either one side or the other, according to the direction in which the car is travelling, and the levers in which the holder is fulcrummed are capable of a vertical movement about their fulcra at either end, and are controlled by the short vertical springs at one end of the base to which they are attached. These springs maintain the levers in their highest position, and admit of a certain flexibility which is called into play when the car is reversed or changes its direction, during which operation the bow has to pass from one side of the vertical to the other, and the versed sine of the angle described by the bow in such movement is compensated for by a dip in the levers due to the extra pressure on the trolley wire which such swinging of the bow would account for.

"Gripper" Nut and Bolt Lock Washer.

The Gripper Co., Ltd., of 2, Bream's Buildings, Chancery Lane, W.C., have just placed on the market the Gripper nut and bolt lock washer, which they claim will effectively lock any nut without placing any strain on the thread, whether screwed down tightly or left slack. The principle of the device can be gathered from the figures, where A is a D-shaped aperture for the bolt, B are spring fingers, and C represent teeth to engage and lock with spring fingers in the washer; D is an aperture of the shape of the nut, hexagon or square, with sides raised slightly to prevent the rotation of the nut. It is claimed that, when fitted, it is impossible to move the nut, even with a spanner, without first removing the locking ring; it can be easily taken off and refitted indefinitely, without injury;

Fig. 2.—The "Gripper" Nut and Bolt Lock Washer.

it can be made of any metal, the principle of its action not depending upon the adoption of any particular material; it is especially adapted for the bolts on engine and shaft bearings, which require periodical adjustment; and, in addition to securing the nut from rotation, the bolt is also held from independent movement.

Premier Charging Set.

A neat little set for charging accumulators is being put on the market by the Premier Accumulator Co., of Northampton; it is illustrated herewith, and occupies a space of only 16 in. cube. The dynamo is coupled directly to a petrol engine, in the design of which special attention has been directed to ensuring reliability of starting and running, points in which such small motors are apt to be

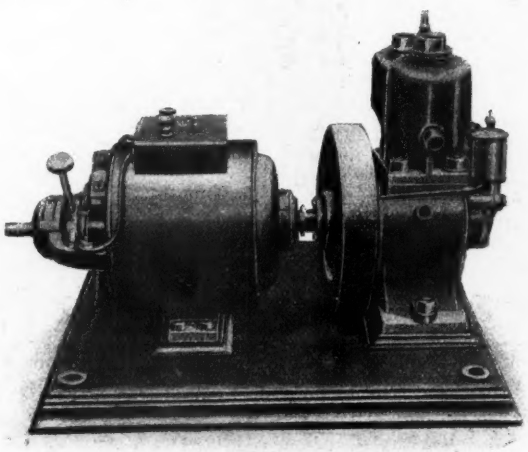


Fig. 3.—The "Premier" Charging Set.

deficient. Electrical ignition is employed, with high compression; the crank revolves in an enclosed chamber, with splash lubrication, and a special carburetter is used. The design of the engine has been provisionally protected. The whole arrangement is very simple, and it is even suggested that it would be worth the while of the owner of a large motor-car to carry such a set on the car itself, to charge his ignition cells. Arrangements are being made to equip charging stations for these cells, and possibly also for the batteries of electric vehicles, at various places.

An Electric Blower.

The Consolidated Pneumatic Tool Co., Ltd., of Palace Chambers, Bridge Street, Westminster, S.W., are introducing an ingenious little portable blower for removing dust from electrical machinery. Hitherto an air compressor has been considered

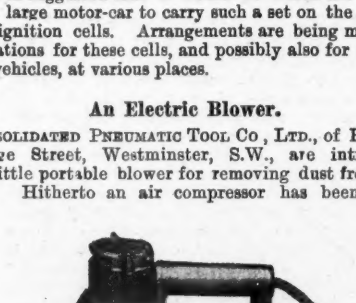


Fig. 4.—Portable Electric Blower.

essential for this class of work, but the above company have designed a light and serviceable piece of apparatus which, to a large extent, takes the place of the larger and more costly air compressor.

It has a small electric motor directly connected to a special kind of fan. The combined apparatus weighs only 12 lb., and it may be worked from any direct lamp socket. It is fitted with a handle on the top, by means of which it can be conveniently manipulated, and we understand that it has already met with a good deal of favour in electrical circles.

Portable Electric Safety Lamp.

The new portable electric safety lamp which we illustrate, has been specially designed by Messrs. D. Santoni & Co. (1906), Ltd., 15 and 17, Beauchamp Street, Brooke Street, Holborn, E.C., for use in collieries. Its weight is 4 lb., and it is supplied in a japanned metal case, and fitted with gas-tight explosion-proof switches and

Fig. 5.—Santoni Portable Lamp.

unspillable accumulators. The lamp can also be supplied with the firm's export dry batteries. A circular just issued (Z—1) by Messrs. Santoni gives price particulars. Another list, which has also just been placed in circulation by them, gives prices of portable accumulators for carriage lighting, ignition, &c.

PROCEEDINGS OF INSTITUTIONS.

Electric Wave Propagation.

By J. E. Taylor.

(*Paper read before the* Institution of Post Office Electrical Engineers (Metropolitan Centre), *January 11th*, 1907.)

Introductory.—The main idea of the treatment I propose to accord to this subject is to formulate and convey physical conceptions or mental pictures of the actions and processes underlying electric wave propagation in its broadest sense. You will at once see that this affords a wide scope of treatment, and I must, therefore, ask to be pardoned if it is presented in a scrappy and disconnected form, for it will not always be possible to merge gradually from one case to another and keep within the prescribed limits of a single paper.

The development of wireless telegraphy with all its inherent possibilities, which are yet only dimly recognised, has lifted the subject of electric wave propagation from the domain of abstract science into the field of practical engineering, and for this reason, if for no other, the need of something more than an abstract physical interpretation of the theory has made itself felt. This has been rendered obvious by the great diversity of opinion and the many unsound views which have been expressed concerning the theory of wave propagation and its effects. I believe that it is a lack of appreciation of elementary principles underlying many of the simplest effects concerned that has constituted the real stumbling block, and for this reason I may perhaps be excused if I commence by touching on very elementary ground.

I propose to approach the subject by directing your attention primarily to electrostatic forces. Clear ideas on this point are essential if the subject is to be attacked from the electrostatic point of view, and I do not think there is any better.

Nature of the Electrostatic Field.—The phenomena of electrostatics primarily manifest themselves in attractive and repulsive forces of an abnormal nature between various bodies. These forces are the result of the electrostatic fields associated with and surrounding electrically-charged bodies, for it must be taken as an axiom that action at a distance, or the production of effects by matter at a place where it is not, is an impossibility. Were this the case, it is hardly conceivable that the effects produced would be amenable to well-established laws. The electrostatic field is an abnormal condition of the medium about a charged body, and this abnormal condition may be rendered evident in many ways. One way is by exploring the medium in the neighbourhood of a high-charged insulated body with suitable vacuum tubes or bulbs, with or without electrodes. Plain glass tubes from which the air has been partially exhausted are sufficient. On approaching a tube sufficiently near the charged body (but much beyond sparking distance) in a darkened room, it may be observed to emit a luminous glow for an instant. If the tube be kept in continuous rotation the luminosity is no longer transient but persistent, in that a transient glow is set up several times during each revolution. The intensity of the luminosity, of course, varies with the distance of the tube from the charged body and with the magnitude of the potential to which it is charged. But the special feature which should be noted is that the luminosity and its accompanying expenditure of energy can be maintained indefinitely without diminishing in the smallest degree the electric charge of the exciting body. The necessary supply of energy is drawn from the force applied to keep the tube in rotation. The vacuum tube with its contents forms part of the medium surrounding the body. The luminous effects produced are thus an indication of an abnormal state of the medium due to the presence of the electrostatic field of force. Instead of rotating a vacuum tube in a steady field, the order may be reversed by alternating the sign of the charge on the body by connecting it to an induction coil, or in any other suitable way. The alternating electrostatic field then produced may be explored without the necessity of rotating the vacuum tube, this constituting the principle on which the historic and brilliant demonstrations by Nikola Tesla were made some 17 or 18 years ago. The electrostatic field is conveniently produced between two conducting bodies or plates, and this plan is usually more effective. It should, however, be borne in mind that at least *two* bodies, one of which is positively, whilst the other is negatively, charged, are always involved, but the earth and earthed conducting surfaces may take the place of one of these bodies, as in the case first quoted.

Numerous experiments may be made which tend to throw light on the nature of the abnormal state of a medium in which such effects are produced, and it has been well established that it is of the nature of a strain tending to dissociate the elementary molecules of the medium, and that, when pushed far enough, such dissociation actually takes place and the molecules are torn asunder, producing, in gases, what may be regarded as a sudden violent chemical action with accompanying luminosity. This is the elementary explanation of the effects produced in vacuum tubes. It is an overstraining of the molecules of the gas, with disrupture and dissipation of electrostatic energy, accompanied by atomic oscillations, the electrostatic field being broken up and rendered non-apparent. That the strain sustained by a dielectric is one tending to tear the parts of a molecule asunder rather than anything in the nature of an expanding or compressing force is upheld by the fact that there is no tendency to distort the medium as a whole No evidence of a dielectric increasing in volume as a result of electrostatic stresses has ever been produced. *Electric strain*, then, appears to be an apt term to denote the state of a dielectric medium sustaining these electric forces. This is not in the nature of an ultimate explanation of electric forces, however, it merely transfers their seat to the ether, for the forces are still existent between moleclule and molecule or atom and atom, just as they are between electrified bodies, though on an inconceivably smaller scale. No further advance towards an ultimate explanation appears probable at present, for it involves knowledge of the nature and constitution of the ether itself; that mysterious connecting medium which permeates all space and all things, and which links together every atom in the universe with every other atom.

Definition of Lines of Strain.—In an electrically-strained medium the strain distributes itself; or, rather, balances itself throughout the medium, along certain definite lines It is what is known as a vector quantity, having direction as well as magnitude, and can be mapped out according to its distribution by the conception of

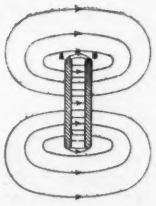


Fig. 1.

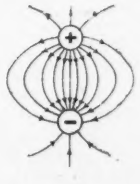


Fig. 2.

lines of strain in much the same way as water in a running stream can be mentally imagined to be mapped out in *lines of flow*. So useful, indeed, is this conception of lines of strain, that it is good in most cases to regard the lines as though they had a real tangible existence. At any point in a medium the lines of strain indicate by their direction the *resultant* direction of the strain at that point, and by their density or number, the magnitude or intensity of the strain. Thus the electric strain in the dielectric between the plates of a condenser is depicted after the fashion shown in fig. 1, whilst that between two spheres is shown in fig. 2.

Molecular Fields.—The latter may also be taken as typical of the molecular field referred to above as existing between atoms or different parts of atoms and molecules. The molecular field may,

for present purposes, be regarded as the ultimate lowest field which can exist. It is never destroyed, and is the source and sink of all electric manifestations. All electric effects are primarily derived from molecular fields which are never created and never destroyed. An electric field, as we know it, is always formed from a combination of multitudinous molecular fields, and the collapse or annulment of such a field involves its breaking up and shrinkage back into fields of molecular dimensions. From this point of view, be it noted, matter is only indirectly concerned; it is only the electric fields associated therewith which are of moment in all electrical manifestations. That is, if matter could be shorn of its molecular electric fields, it would have no effect whatever on any electrical manifestations. In the so-called frictional effects and in all forms of contact effects, there is an amalgamation of molecular fields between the two surfaces in contact, the *raison d'être* of which will be rendered more obvious presently. The amalgamation is accompanied by ultra-molecular interchanges between the surfaces in contact, so that when separated they remain connected by electric lines of strain which are stretched or drawn out in the act of separating, almost like so many elastic threads. They may be regarded as tending to contract themselves with a force proportional to their length, and may be elongated or stretched by separating the surfaces to which their ends are attached (fig. 1). Consider, for simplicity, that the surfaces are the opposing surfaces of two metallic plates. The lines of strain are stretched out, forming an electric field, and the longer they are made the greater is the electrostatic energy developed. On account, however, of the property of the strain to distribute itself laterally through the medium, the increase of energy becomes smaller and smaller as the distance of separation relatively to the sizes of the plates becomes larger.

It is hardly necessary to explain that what are called positive and negative charges correspond with the beginning and end of a line of strain. Lines of strain themselves are neither positive nor negative, except in the sense of their having a positive or negative *direction*.

Distribution of Lines of Strain.—Figs. 3, 4, 5 and 6 indicate the way in which the electric lines of strain distribute themselves about conducting bodies of various shapes, the distribution being regulated largely by the fact that a static strain at the surface of a conducting body is only stable or balanced when the resultant strains (*i.e.*, the lines of strain) are normal to the surface. This accounts for the various different surface densities of charge on bodies of various

FIG. 3. FIG. 4.

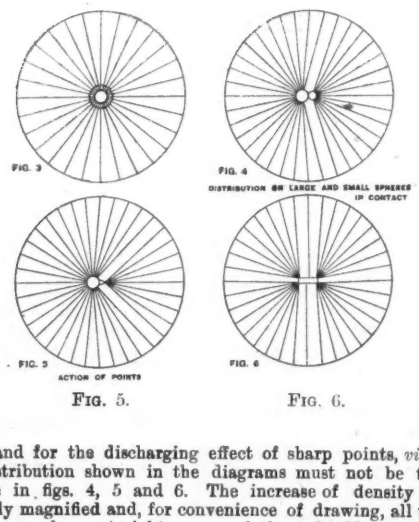


FIG. 5. FIG. 6.

shapes and for the discharging effect of sharp points, *vide* fig. 5. The distribution shown in the diagrams must not be taken as accurate in figs. 4, 5 and 6. The increase of density has been purposely magnified and, for convenience of drawing, all the lines of strain are shown straight; many of them should be curved near the conducting surfaces so as to be normal to those surfaces. The intensity of the strain in a dielectric medium being proportional to the density of the lines of strain, it follows that disruption will occur first at the point of greatest density, and this is always the point of sharpest curvature which is not screened by other parts of the surface, *i.e.*, where the surface is not re-entrant. In the case of an exposed point the disrupture usually manifests itself as a noiseless luminous "glow," which becomes an intermittent "brush" as the curvature decreases, and ultimately an electric spark. The electric spark, then, is a manifestation of complete disrupture of the dielectric, the medium traversed being temporarily converted into a conductor, affording a connection whereby the whole energy of the electrostatic field is released.

The Nature of an Electric Spark.—Regarded from this point of view, the electric spark partakes rather of the nature of a physical process than as an effect due to the so-called "passage of electric charges." This view is strengthened by several experimental results. It is well known that the perforation of cardboard, the leaves of a book, or other solid dielectrics of fibrous texture by the discharge of a condenser, results in the production of a characteristic outward burr on each side of the perforation. The only satisfactory explanation of this effect is that the spark is an explosive disrupture of the dielectric, and that the explosion exerts most force where the dielectric is strongest. Cardboard being a stronger dielectric than air causes the internal explosive force inside the cardboard during disruption to overcome the external explosive force in the air, hence the edges of the perforation are blown outwards on each side. A very similar illustration of the explosive character of a condenser spark is given by the difficulty which is experienced in eliminating sparking at the contacts of a telegraphic relay when a condenser is connected across them. If the tongue of the relay be moved firmly with the fingers, there is practically no spark observable, but immediately it is left to move, in virtue of the attraction of the magnetised cores, vigorous sparking takes place. The explanation is that in moving the tongue with the fingers there is no jarring of the tongue on the contact while the condenser is discharging. On the other hand, if the tongue moves solely in virtue of the attraction of the cores, it jars slightly on impact, and the condenser discharge is effected for an instant through a microscopic air gap. The explosive force of this discharge blows the contacts further apart, and thus the initial microscopic spark becomes magnified into something very real.

A further illustration is afforded by the peculiar way in which tubular lightning conductors frequently buckle up and collapse when struck by lightning. This is, of course, accounted for by the explosive violence of the flash producing great external pressure on the tube.

It is not generally recognised that the spark discharge, even as manifested in the brilliant snapping form which it takes when a condenser, or Leyden jar, is discharged, is preceded by a rapid

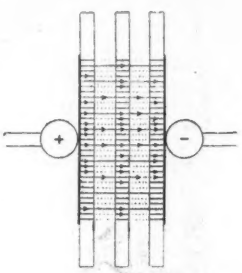


FIG. 7.

evolutionary stage in which it assumes in sequence all the lower forms represented by the glow, brush, the thin meandering or pilot spark, and the final snapping explosion. So rapidly are the successive forms displaced, however, when there is sufficient energy behind the discharge, that the final stage only is appreciated.

The nature of disruptive effects in dielectrics can be illustrated in a very neat way by using dielectrics of different strengths in uniform electrostatic fields. Thus, if a mixed dielectric consisting of two parallel sheets of clean dry glass, separated by a layer of air, be brought into a powerful field such as that between the poles of an influence machine or an induction coil, the weak air dielectric between the plates will give way without producing any internal effect in the glass. The collapse of the air dielectric is accompanied by a distributed luminous blue glow which can be seen by looking between the plates. The effect can also be observed between the plates of any Wimshurst influence machine in operation either at the upper or lower parts of the plates. If a small sheet of clean dry glass be inserted between the rotating plates and quickly withdrawn, it will be found to be charged. If tinfoil sheets be placed on either side, the glass sheet can be discharged, just as a charged condenser, the usual condenser spark being obtained. A similar experiment is illustrated in fig. 7, and the arrangement of electric field finally assumed is shown.

It has already been suggested that the redistribution of lines of strain about a charged conducting body, to meet changes in its disposition with respect to other conductors, or, in general, to readjust the equilibrium of dielectric strain, is effected by a lateral motion of the lines, or that a readjustment takes place which is equivalent to a lateral motion. This property renders the assumption necessary that lines of strain are endowed with the faculty of gliding over conducting surfaces to new positions with the expenditure of

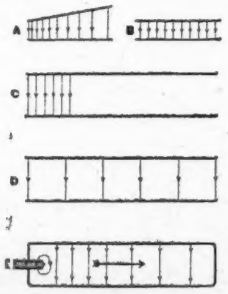


FIG. 8.

a very small proportion of their energy under suitable conditions, the amount of energy expended being irrespective of the nature of the conductor—*i.e.*, independent of resistance. A simple example of this redistribution process is afforded from a consideration of two wires or strips *a b* and *c d* (fig. 8), between which an

electric strain exists. If these are inclined towards one another the strain will be more concentrated at the nearer ends. If now *a b* be made parallel to *c d*, the field will become symmetrical in virtue of the faculty of lateral motion of the lines. Imagine two parallel conductors with a field concentrated between them at one end as at C (fig. 8). The field will have a tendency to expand laterally, and if left to itself the expansion will occur as at D. This enables one to depict the preliminary stage of a condenser discharge in a conducting circuit, E (fig. 8), the propagation of guided waves along conductors, and the initial stages of the formation of steady currents; matters which will be more fully referred to presently. In connection with the lateral motion of lines of strain and the constitution of conductors, whereby such guidance is rendered possible, it will be necessary to consider another property of lines of strain.

Interference and Fusion of Electric Fields.—Attention has as yet only been directed to solitary electric fields in this paper. It will be useful to consider how two or more such fields will behave when superposed or brought near one another. If the fields are of the same sign and similar in all respects, the redistribution is simple and will be of the kind shown in the upper part of fig. 9. With

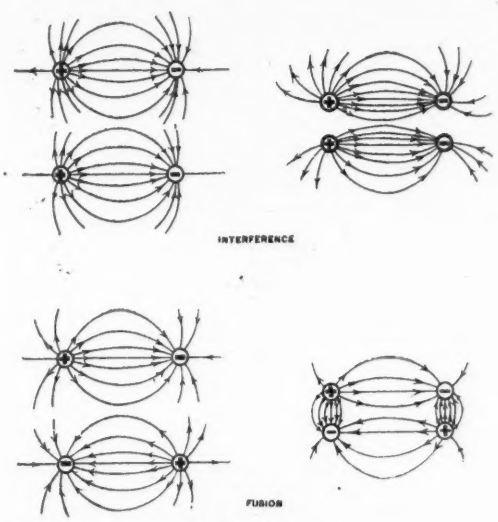


FIG. 9.

fields of opposite sign the effect is much more complex, as the superposition of lines of strain having a positive direction upon other lines having a negative direction is involved. In virtue of the axiom that there cannot exist two equal and opposite resultant forces at one point, it follows that the lines will annul one another in parts, and cause a change in distribution throughout the whole system. The result is that some portions of the lines of the first system dissolve where they meet those of the second or superposed system, and link up with them in new positions as shown. This property of lines of strain will be called *fusion of strain*, as against *interference* of similarly directed lines. The property of fusion of lines of strain appears to afford an explanation of several effects which are otherwise somewhat puzzling and difficult to interpret physically. Fusion of lines of strain can be brought about by the agency of a conducting body introduced into an electric field (fig. 10). On approaching a conductor—say, a metal sheet—towards

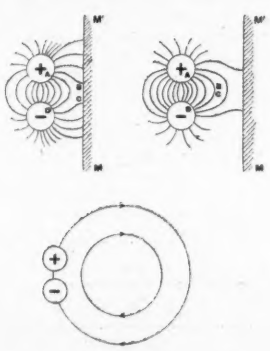


FIG. 10.

the system shown in the figure, some of the lines dissolve off at their centre and attach themselves to the conducting sheet. On withdrawing the sheet they fuse on to one another again as at first. If by any means the ends of the lines which normally terminate on the charged spheres shown in the lower part could be brought together, they also would dissolve from the conductor, link up together, and form a self-closed field of force existing independently of the spheres; in a purely dielectric medium; electric fields without electric charges. This, indeed, happens in the case of electric radiation.

Wave Guidance.—Returning now to the question of wave guidance by conductors, it is only necessary to assume that conductors possess molecular fields capable of producing the effect of fusion, and that these molecular fields are equally distributed throughout the conductor, that is, that they exist in equal strength between molecules and between the atoms of a molecule (or between electron and atom), and we have to hand an explanation of the phenomenon of wave guidance in all its aspects. This theory may be new or old. It is probably old, but it appears to shed considerable light on the subject.

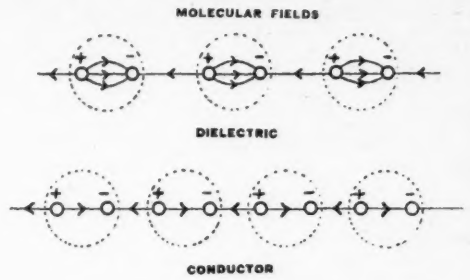


FIG. 11.

It is, of course, only reasonable to assume that conductors and insulators alike possess molecular fields, but it is not difficult to imagine that the internal molecular fields of insulators over-power and out-balance the fields between molecule and molecule, whilst in conducting media a state of exact balance is maintained (fig. 11). Now, it can be shown that, whilst an electric line of strain brought into a field of the former kind would be taken up by the medium

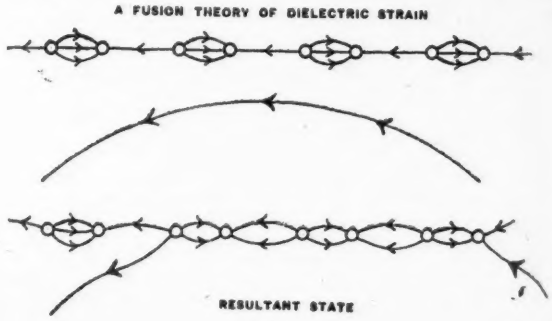


FIG. 12.

and a displacement strain produced (fig. 12); in the latter case (fig. 13), the line is taken up by the medium, a momentary re-arrangement of molecular fields takes place, but *no displacement strain* is produced; the medium is at liberty to resume its original arrangement of molecular fields,* with the result that, in

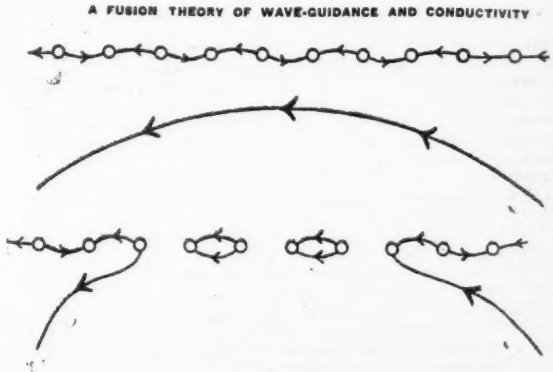


FIG. 13.

effect, the line of strain is passed on intact, without loss of energy and without permanent alteration of the molecular disposition of the conducting medium. The theory also lends itself to explain differences in degrees of conductivity in different conductors on the

*The ultimate particles of all materials, conducting and insulating alike, are continually in a state of very great agitation and re-arrangement, corresponding to normal temperature at which matter is maintained.

assumption that varying degrees of opposition (of a non-reactive kind) to the formation of the necessary chains of molecular fields, are encountered which imply energy dissipation.

Reverting again to the dielectric process, it should be pointed out that, after disruption, the dielectric remains conducting for some time. It has two options for exhibiting this conductivity—(*a*) the detached corpuscles may carry the ends of the lines of strain through the medium: (*b*) the corpuscles may be in sufficient number to cause a balancing of the external and internal molecular fields, and so produce conditions suitable for conductivity by the process of fusion.

The first is the method of conduction obtaining in high vacua, while the second is assumed to be that obtaining in metallic conductors in which the Hall effect is absent. Other cases of conductivity will generally be compounded of both forms.

(To be continued.)

Underground Mains.

By W. M. Rogerson, A.M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *at Halifax, March 21st*, 1907.)

Lead-covered cables, properly protected, should last for an indefinite period. Care should be taken to seal the ends, and if the cable is drawn into conduit, it should be well greased, and the conduits cleared, before drawing in. Every possible care must be taken to make the lead sheathing continuous throughout, at all junctions, service boxes, &c. Lead-covered cables are not suitable for a large system of distribution where services and disconnecting boxes occur at frequent intervals, but as feeders, the only trouble they incur is through electrolysis. Compounds for filling joint boxes should be most carefully chosen. The chief cause of electrolytic action is current in the lead sheath, derived from imperfectly made joints or end conditions.

The life of rubber-covered cables drawn into conduits is generally very short, due to the presence of moisture in the conduits. The author has had very little trouble with bitumen cables, but where alkaline matter is present the solid system of laying should be adopted.

Local pressure on bitumen cables should be avoided, and they should not be taken round sharp corners. The author has never found the conductor decentralised unless the cable has been heated by overloading; where there is danger of this, a paper sheath covered with vulcanised bitumen overcomes the objection. The best method of laying bitumen cables is the solid system, in tarred or creosoted wood. The weak points are the bridge pieces, whether of porcelain or hard wood troughing; the author uses bridge pieces cast of hard bitumen (the sediment left in the bottom of the bitumen pans) which unite with the hot bitumen and seem likely to prove satisfactory. Asphalt troughing is also satisfactory, and can be used, run solid, for old rubber cable; it requires no bridge pieces.

Armoured cable laid direct in the ground is the least costly to lay and maintain of any form of cable. Bare copper in conduits has been to a great extent abandoned.

Disconnecting pillars and boxes are very necessary, so that any feeder and its network can be quickly isolated to localise a fault. The extra cost of these is amply repaid in practice, especially as the growing use of electricity for motive power renders it almost impossible to disconnect any large portion of the network for testing during week days. Pillars are far preferable to underground boxes, and cost no more in the end.

Distributing networks should be fused in all interconnecting boxes and pillars, the fuses being arranged to carry current up to the safe carrying capacity of the main. Enclosed type fuses are not recommended for this purpose. Copper and tin are objectionable materials for the fuses; the author has found aluminium the best metal, as the arc appears to be confined to a very small space and no violent explosion takes place. At first, local action between the fuse and the copper clip which held it gave much trouble, but by polishing the fuse strip with black lead, where it came into contact with the copper, the trouble was overcome. Fusing the network is an absolute necessity in the case of concentric cable, as a long length may be destroyed in a very short time in the absence of a fuse.

The use of wood or vulcanised fibre of any sort for insulating purposes on outdoor work is to be condemned. The only reliable material is hard glazed porcelain, preferably with double insulation. Underground boxes with bolted covers, the joint being made watertight with red lead, are objectionable; the author has found the diving-bell type of cover satisfactory.

Single-conductor cables are the most convenient to handle, as only one at a time need be dealt with, and services are easily connected without interfering with the general supply. Multicore and concentric cables present no special advantages.

Discussion.

Mr. G. Wilkinson (Harrogate) said: Regarding the danger of electrolytic action, in my opinion the safest system is that where there are as few joints as possible, and these located above the ground. Where this is impossible, "plumbed" joints are to be preferred underground. Where joint boxes are used with compo glands, my experience is that unless the lead is thoroughly cleaned and freed from the cable oil, there is liable to be a slow creepage of moisture between the lead and the compo. Also in many instances these compo glands are made too short to be reliable. In order to get over these difficulties, some years ago I made a tool which corrugates the lead where it goes through to the glands. This has the effect of greatly increasing the surface within the gland, and exposing the clean pure lead, to which the compo will tenaciously adhere; also the corrugations form a very secure bind in the compound. With these joints it is absolutely necessary that the lead of the cable be well earthed by bridging over from side to side by a copper bridging piece, thus securing the continuity of the earthing. With lead-covered cables, unless they are effectually earthed, one fault generally will produce two or three following in succession; not only should the lead covering be well earthed at the station, but I have found it advisable to employ freely throughout the distribution network earthing stakes, which are driven into the damp ground, and at the top furnished with an earthing screw to which the lead of the cables is connected. The employment of this additional earthing device has produced entire freedom from the trouble named.

Mr. F. C. Raphael regretted that Mr. Rogerson had not been able to explain why a three-core cable was no cheaper than three single cables of the same sectional area, and pointed out that at any rate the cost of ducts and laying was less in the former case. He still believed in armoured cables laid directly in the ground whenever circumstances would permit it, and preferred the joint-box with the lead jointed to a sleeve by a plumber's joint, to the ordinary split-box with the pockets containing compound. The solid system in wooden triangles had never appealed to him as a real engineering proposition. The difficulty with the supporting bridges on the solid system was got over by using the U-shaped iron suspenders adopted by the British Insulated Co. He emphasised the importance of using fuses on feeders rated at the full overload capacity of the feeder, and suggested that a series of tests would be valuable to compare the overload capacities of ordinary lead-covered and vulcanised bitumen cables having the same copper section. He did not approve of abolishing the fuse carrier.

Mr. W. Emmott (Halifax) said he preferred lead-covered and armoured cables laid direct in the ground, and would rather have separate cables than triple-concentric. His experience was that three-core cables cost a little more and entailed more labour in laying and handling, but the extra cost was well repaid. In the case of a section about 1,400 yds. in length, the manufacturers agreed to guarantee the cable at the rate of 1 per cent. on the capital outlay, on the understanding that the feeders were not interfered with in any way.

Mr. F. Spencer (Halifax) said he agreed very much with Mr. Raphael regarding the laying of the cables direct in the earth. In Staffordshire the cables were laid direct in the ground, and gave considerable trouble; they did not know where the joints were, and the feeder boxes were in the ground. Frequently these were filled with water, which was invariably boiling. They had eventually to put in boxes built of brick about 2 ft. 6 in. long, 1 ft. 6 in. wide × 2 ft. 6 in. deep, with creosoted timber across the box 1 ft. 6 in. from the bottom, where the connection and fuses were fixed. He remembered the trouble they had with bare conductors so well that he would not care for a repetition.

Mr. H. Dickinson (Leeds) said that whenever a man capped a cable, they made him put his initials on the cap. They used earthenware troughs of various sizes, and at first used an earthenware bridge, but found that it was not very satisfactory. They had now adopted corrugated iron strips, which fitted tight inside the ducts, and upon which the cables rested. In Leeds the electrolysis was no doubt due to the leakage of the tramway current, and the tramways department got over that by putting in negative boosters. They preferred the compound a little brittle, as it would chip out very much easier than if it were sticky. It made a very good job and set close round the fittings, but the fittings came out quite clean. On the other hand, if the compound was sticky, the fittings were practically useless, as the compound adhered, and it was difficult to detach it. In Leeds they had rubber cables originally, and had a bad experience with them. If one went wrong, they nearly always had others. If thunder showers came on they always had faults. They had had no trouble with the concentric cables. The high-tension cables were armoured and laid solid in earthenware troughs, with tiles on the top stamped "electric." The same system was also used for the L.T. cables, to which power circuits are connected. He thought it was essential that the reliability of the system should be the first consideration. He thought the point mentioned by Mr. Raphael that the paper cable would stand a greater overload than the bitumen, was a very important one, as the paper could not be decentralised, and the bitumen could. It was most important to keep a very full record of everything that happened on the mains, such as every service and every joint, and if any alteration were made it should immediately be put on the record. In Leeds they had a very large system, and intended keeping a duplicate copy of the mains in a safe; they also intended photographing their maps, which filled about seven books. It was essential to have a duplicate copy, for in the event of fire they would be unable to complete them again.

Mr. W. H. F. Murdoch (head of the electrical department, Technical College, Halifax) said he thought aluminium a good substance for making fuses, one of the reasons being that its disintegration in air was less than that of other metals. A great deal had been written in the Continental papers relative to the effects of surgings; in the event of a short circuit on a low-tension network—say, 150 volts—the potential was raised, and they might get as much as 5,000 volts for a short time. He had never heard whether a cable had been pierced by these sudden pressures, and it would be rather interesting if one could get some information on this point.

Mr. A. B. Mountain (Huddersfield) said with regard to the size of the middle wire on a three-wire system, that he had always found that the accepted idea of 6 to 1, which was very common practice, was too low; the section of the middle wire should be almost 7 of, or equal to, that of the outer wires. There did not appear to be any standard.

Mr. Rogerson, in reply, said that he did not experience difficulties in making good joints with split boxes, if the jointer cleaned the lead sufficiently. All the quotations he had had for three-core cable were higher than for three separate cables, but he did not know the reason. He did not approve of iron bridge pieces, as there might be danger of electrolysis where they touched the cable. The overload capacity of lead-covered cable was higher than that of vulcanised bitumen cable; but he knew of a case—not in Halifax—where a ·25 sq. in. bitumen cable carried 1,000 amperes for many years. The Halifax, Nottingham and Liverpool Corporations all had the power to apply to a magistrate for compulsory consent to a reasonable demand on the part of the undertaker to fix wall brackets. Like Mr. Emmott, he had been given maintenance contracts for cables—500-volt armoured cables laid directly in the ground, and also some laid on the British Insulated solid system in earthenware ducts—at 1 per cent. of the capital cost. He had no difficulty in removing the compound from joint boxes with a hot spoon, and did not chip it out as Mr. Dickinson did. Wooden troughs would last if properly creosoted. The size of middle wire he adopted was generally half the section of the outers. His negative wire gave him more trouble than his middle wire.

Electricity Applied to Mining.

At the ordinary meeting of the Institution of Civil Engineers, on Mar h 26th, a paper was read on "The Application of Hydro-Electric Power to Slate Mining," by Mr. M. Kellow, A.M.I.C.E.

The slate mines of Wales are situated in mountainous country, which greatly facilitated mining and quarrying operations in the past, as it enabled the slate beds, which incline at high angles, to be worked by adit levels and horizontal galleries directly from the hillsides, and a small amount of power only was required under these circumstances. The conditions tend to become less favourable every year, as the workings become deeper, and as also mechanical aids in the manufacture of slate tend to become more universal, the requirements, as regards power, must increase considerably.

Though steam has hitherto been chiefly used, there is an abundance of water-power in the district, and there is little doubt that when the advantages of utilising water-power in conjunction with electrical transmission and distribution are generally realised, it will be used almost to the exclusion of any other in slate-mining.

The author has designed and installed a hydro-electric plant in the Croesor and Cwmfoel Valleys in the vicinity of Snowdon, where a reservoir 12 acres in extent has been constructed at an elevation of 1,460 ft. above the sea, giving an available head of water of 860 ft. The three-phase alternating current system was adopted, with a frequency of 40 cycles.

The essential qualities in mining plant are stated to be reliability, first-class mechanical construction, and simplicity of operation, and as regards motors, these conditions are best fulfilled by the three-phase induction type. Group-driving by moderate-sized squirrel-cage motors is favoured.

At the same meeting a paper was read on "Electrically-Driven Winding Gear," by Mr. A. H. Preece, M.Inst.C.E.

The author discusses the questions relating to winding in the first portion of the paper, and in the second portion he refers to various points relating to the cost of electric power in mines. He considers that the losses through friction at starting with winding-gears are of great importance, as a winding-gear is stopped and started sometimes as often as 70 times per hour. Hence a method of driving which is enabled to start with little friction loss is certain to prove economical, when compared with steam engines.

Two-stage winding is no doubt open to many objections, but there is little doubt that the use of electricity would overcome one of the chief objections by avoiding the installation of boilers half-way down the shaft. The use of electrical winding may improve the working with ropes so that it will be possible, by using a factor of safety of 6, economically to wind materials from a depth of 6,000 ft. in a single wind, and thus obviate the necessity for two-stage winding.

The Koepe pulley has been largely adopted in Germany with electrically-driven winding gears, together with balanced ropes, and the working of such pulleys appears to give every satisfaction. The work put into heavy cylindrical drums during acceleration may, no doubt, be recovered during retardation, but if rapid acceleration is required, the maximum horse-power is necessarily very great with cylindrical drums, and is considerably in excess of the normal power required at full speed.

The author points out that the driving of winding gears by electricity is not entirely similar to electric-traction problems. There are many new features which require careful consideration. It is essential to study the inertia of suspended loads, the momentum of the winding gears, the static and dynamic stresses on the ropes, and the friction of the shaft, as well as the acceleration and retardation.

The advantages of the fly-wheel system are discussed in detail, and figures are given as to the efficiency with fly-wheel motor-generators. In the case of a 40-ton fly-wheel, with a motor of 240 kw. and a generator capable of dealing with about 600 kw. maximum, the constant loss due to air-friction and windage was about 17 kw.

The supply of power in mining districts by bulk companies is attracting considerable attention at the present time. To the mine owners it is purely a question whether they can erect electrical plant and produce electricity themselves at a lower rate than the prices at which the bulk company is prepared to supply them.

Interest and depreciation form one of the largest items, and in the case of mining companies, as the life of a mine is limited, the rate of interest should be high.

It is shown that for a mine having a demand not exceeding 2,500 kilowatts, and with coal at 6s. per ton, the cost per unit with a load-factor of 20 per cent. is about 0·64d., while with a load-factor of 50 per cent. it is 0·31d. The margin with a 20 per cent. load-factor below the price chargeable by a bulk company would probably be so small that it would be better policy to purchase energy. In the case of the higher load-factor, it is doubtful whether a power company could compete with a local generating station.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

7,515. "Improvements relating to electric and other furnaces." The Grondal Kjellin Co., Ltd., and J. Harden. March 28th.

7,657. "Improvements in or relating to the connecting and disconnecting of the sockets of incandescent electric lamps." J. W. Waring and J. B. Waring. April 2nd.

7,663. "Improvements in vibrators for siphon recorders used in working submarine cables." T. D. Taylor. April 2nd.

7,664. "Improvements in supports for electric lamps." P. Tonks. April 2nd.

7,687. "Improved method and means of radio-telegraphy and radio-telephony." J. H. Webb. April 2nd.

7,695. "Improvements in or relating to dynamo-electric machines and motors." Siemens Brothers Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany). April 2nd. (Complete)

7,711. "Improvements in electrical shunts." J. B. d'Homergue. April 2nd. (Complete.)

7,712. "Improvements in electro-pneumatic track channelers." H. H. Lake. (Ingersoll-Rand Co., United States.) April 2nd. (Complete.)

7,737. "Improvements in or relating to electric lifts or hoists." R. Waygood and Co., Ltd., and D. Bone. April 2nd.

7,742. "Improvements in electric furnaces." S. O. Cowper-Coles. April 2nd.

7,757. "Process and apparatus for the electrolysis of alkali chlorides or the like." J. Billitzer. April 2nd. (Complete.)

7,768. "Improvements in and relating to circuit-breaker mechanisms." J. G. Statter. April 3rd.

7,785. "Improvements in duplexing telegraph lines." I. Kitsee. April 3rd. (Complete.)

7,791. "Improvements in electric transformer furnaces." E. A. A. Grönwall, A. R. Lindblad and O. Stalhane. April 3rd. (Complete)

7,800. "Improvements in and relating to conduits for electrical cables and wires." W. G. T. Goodman and E. W. Ackland. April 3rd. (Complete.)

7,819. "Improvements in pendulum-controlled electric circuit-closing devices." G. B. Bowell. April 3rd.

7,826. "Improvements in wall or ceiling roses or unions for gas and electric conduits." A. Furch. (Date applied for under Patents Act, 1901, November 24th, 1906, being date of application in Germany.) April 3rd. (Complete.)

7,844. "Faradic medical (tubular) battery." W. Thompson. April 3rd. (Complete.)

7,853. "Improvements in the distribution of electricity more particularly adapted for electric railways and tramways." J. R. Salter. April 4th.

7,864. "Electro-thermal calorimeter." W. P. Digby and C. W. V. Biggs. April 4th.

7,865. "Improvements in system of controlling automatic push-button electric lifts, hoists and the like." G. A. Minshall. April 4th.

7,883. "Improvements in electrically-controlled elevators." C. Naujoks, F. Naujoks and G. Goeppert. April 4th. (Complete.)

7,924. "Improvements in and relating to arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 4th.

7,926. "Improvements in electric lamps." H. S. Hatfield and F. M. Lewis. April 4th.

7,931. "Improvements in or connected with electric winding appliances, and the methods of operating the same." P. H. Dawe. April 5th.

7,933. "Improvements in and relating to the electric transmission of power from a prime mover." B. D. Archibald. April 5th.

7,911. "Improvements in electric arc lamps." H. Bevis and A. E. Angold. April 5th.

7,963. "Improvements in or relating to low-tension ignition mechanism, particularly for use on motor vehicles and the like." E. W. Lewis and The Deasy Motor-Car Manufacturing Co., Ltd. April 5th.

7,982. "Improvements in and relating to electro-magnetic separators." W. Blackmore. April 5th.

7,994. "Improvements relating to single-line intercommunication telephone systems." I. B. Birnbaum and H. G. White. April 5th.

8,019. "Improvements in systems of electric-motor control and apparatus therefor." G. H. Hill. (Date applied for under Patents Act, 1901, April 7th, 1906, being date of application in United States.) April 5th. (Complete.)

8,020. "Improvements in systems of electric-motor control." British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) April 5th.

8,055. "Improved method of attaching electric alarms to clocks." A. Wright. April 6th.

8,079. "Improved method and means for controlling electric motors." H. W. Leonard. April 6th. (Complete.)

8,096. "Improvements in and relating to transformers for electric lamps and other apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 6th.

8,097 "Improvements in alternating-current commutating electric machines." Ateliers Thomson-Houston (Anciens Etablissements Postel-Vinay). (Date applied for under Patents Act, 1901, April 7th, 1906, being date of application in France.) April 6th. (Complete.)

EXPIRING PATENTS.

(Continued from page 624.)

10,296. "Dynamo-electric machines." W. B. Sayers, Bearsden, near Glasgow. May 24th, 1893. Relates to dynamos and motors of the kind in which the commutator strips are connected to the sections of the armature winding through "commutator coils" in which an E.M.F. is set up when the machine is running, the object being to prevent sparking, &c. The present invention consists in arranging the commutator coils longitudinally upon or within the periphery of the armature, so that the side portions are located on opposite sides of a section, or sections of the armature winding, to a part of which one end of the commutator coil is connected, its opposite end being connected to the commutator block. When the two armature sections are located symmetrically between the side portions of the commutator coil, the generator or motor may be run in either direction. To make the commutator coils more powerfully operative, the tips or horns of the field magnet pole-pieces are provided with recesses equal in width to the distance between the two side parts of each commutator coil. The said recesses may be formed by means of suitably shaped polar extensions. Insulated wire coils connected up in shunt or series, may be wound in the recesses to control the magnetic flux through the projecting horn. Electro-motors are provided with brush-holders carrying radial brushes, and mounted so as to automatically move through an arc when the armature is reversed, to give the brushes the proper lead in the new direction of rotation. Stops are provided to limit the movement of the brush-holder.

10,584. "Electrolysis." H. Y. Castner, of London. May 30th, 1893. Relates to means for tilting cells, in which an amalgam of mercury and sodium is produced by the electrolysis of sodium chloride, and is then transferred to another cell or compartment for separation of the sodium as caustic soda.

11,973. "Electrolytic apparatus." Siemens Bros. & Co., Ltd., Westminster, and E. F. A. Obach, Kent. June 17th, 1893. Relates to apparatus of the voltameter type for the electrolysis of water, the oxygen and hydrogen being collected separately.

13,336. "Electrolysis." C. Hoepfner, of Giessen, Germany. July 8th, 1893. Relates to preparing by electrolysis nickel, cobalt, zinc, lead, tin, copper and chlorine. The cathode is immersed in a solution of the metal, which is either neutral or is mixed with weak acid, and is arranged either to rotate or to vibrate. The electrolyte surrounding the anode may alternately be raised or lowered in its level by means of a pump, &c. The anodes and cathodes are arranged in series, so that each anode cell is between two cathode cells. Separating the anode and cathode compartments are diaphragms formed of nitrated cotton or linen, strengthened, if necessary.

13,339. "Carbon." H. H. Lake. (A. C. Girard and E. A. G. Street, both of Paris.) July 8th, 1893. Relates to the preparation of graphite carbon, by heating any ordinary or prepared carbon to a high temperature obtained in an electric furnace.

13,340. "Electric furnaces." H. H. Lake. (A. C. Girard and E. A. G. Street, both of Paris.) One form of construction of the electric furnace is adapted for heating of rods of conducting material, and consists of an exterior casing, which is provided with a block of refractory material through a channel in which the rod to be heated, which forms one of the electrodes, is fed. The second electrode is formed by a carbon rod, which passes through a stuffing-box and a radial channel in the block of refractory material. By means of other stuffing boxes and tubes, any required gas may be passed into the heating chamber. The arc may be caused to rotate by producing a magnetic field in the furnace.

13,722. "Ammonia, caustic soda and chlorine." C. Kellner, of Vienna, Austria. July 14th, 1893. Relates to the production of ammonia and caustic soda, by treating a heated sodium nitrate solution with sodium amalgam, the latter being produced by the continuous electrolysis of sodium chloride solution using a mercury cathode, in which process chlorine is also produced. During the production of the ammonia and caustic soda, mercury is re-formed for reuse, and an electric current is produced, which can be employed to help in the electrolytic process, or be used for other purposes. The electrolytic vessel is charged with sodium chloride solution from a tank through a suitable tube, and a projection directs the solution against the under surface of the carbon or platinum anode. Mercury, forming the cathode, enters at the opposite end of the electrolytic vessel, and is caused to have a whirling motion by a spiral projecting rib in the bottom. The mercury has a less surface than that of the anode. Chlorine is evolved and passes away through a tube at the top of the electrolytic vessel; the exhausted saline solution flows off through another tube back to the tank to be enriched, and sodium amalgam, which also forms, falls into a funnel and flows through into a second vessel. This latter vessel is provided with a corrugated inclined sheet-iron bottom, above which is a grate supported by wires. The vessel is closed by a cover, the edges of which enter grooves filled with water. Sodium nitrate solution flows in from a tank through a tube being heated by a steam pipe. A reaction ensues, whereby ammonia is evolved and escapes through a pipe, caustic soda solution forms and flows off, and mercury passes off from the lower end of the second vessel to a cooling coil. From this latter the mercury enters another vessel, and is then forced by the pump through a tube back to the electrolytic vessel. During the reaction in the second vessel an electric current is set up, which is collected and led away by wires connected to the layer of sodium amalgam and the grate above the corrugated iron bottom of the second vessel. The surface for the sodium amalgam in this second vessel is much larger than the surface of the mercury cathode in the electrolytic vessel.

14,130. "Electrolysis." J. Hargreaves and T. Bird, both of Lancashire. July 21st, 1893. Relates to the application of electrolytic apparatus for electrolysing iodides, bromides, nitrates and other salts, and obtaining iodine, bromine, nitric acid and other products, except alkalies. Either the anode, the cathode, or both, are permeable or perforated, and each is separated from the electrolyte by means of a porous diaphragm to which it is attached. The product obtained is yielded up on the surface of the electrode, and removed therefrom by means of steam or vapour or a jet of liquid.

14,131. "Electrolysis." J. Hargreaves and T. Bird, both of Lancashire. July 21st, 1893. Refers to specifications Nos. 5,197 and 5,198 of 1893 (see Elec. Rev., p. 544, March 29th), and relates to improvements in electrolytic apparatus of the nature described therein for electrolysing chlorides, iodides, bromides, nitrates and other salts. The cell consists of an upper anode compartment of stoneware or like material, connected by bolts to two lower metal compartments cast in one piece, whereof one is the cathode compartment, and the other a passage for waste gases, heated carbonic acid from any source, or steam on its way to the central compartment. The anodes are supported in the anode compartment, the base of which is formed of a porous diaphragm to which the wire gauze cathode is attached. The diaphragm is formed of a pulp composed of fibrous material, such as asbestos, and a binding material consisting of an insoluble phosphate. The salt solution to be electrolysed, as brine, enters the anode compartment at one side, and passes away through an opening in the opposite side, while any gases evolved pass away through a tube above this opening. The gases passing through the waste gases compartment, warm the floor of the cathode compartment, and afterwards wash off the alkali formed on the cathode, or if carbonic acid is present, convert it into carbonate, which flows away through a tube.

14,556. "Lamps, &c." R. T. Preston and A. B. Gill, both of Kent. July 28th, 1893. Pendants. Relates to the substitution of fusee springs for counterbalance weights. The invention is described in connection with a support for an electric lamp. One end of a flexible support of the electric lamp is secured to a pulley having a casing containing a fusee spring, which, when wound up, tends to coil the flexible support-cord upon the pulley. The cord is, however, passed over another smaller pulley which is carried by wires. The weight of the lamp acting on the small pulley normally causes the wires to press against the pulley and serve as a brake. But by moving the flexible cord in a certain direction the brake is taken off, and the lamp may be raised or lowered.

15,450. "Clocks." A. Frank, of Berlin. August 14th, 1893. Synchronising and winding. In an electric system for synchronising or winding distant clocks from a standard one at a central station, a separate operating current is sent to each clock, and the durations of the currents are indicated or recorded so that the working condition of any clock is thereby known.

(To be continued.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

Wireless Telegraphy. Sir O. J. Lodge and A. Muirhead. 25,490. December 7th.

1906.

Regulating Mechanism for Electric Arc Lamps. J. Brockie. 5,555. March 7th.

Electro-Magnetic Switches and like Electro-Magnetic Mechanisms. M. B. Field and Ferranti, Ltd. 5,952. March 12th.

Electric Switches. British Thomson-Houston Co. (General Electric Co.) 6,006. March 13th.

Conduit for Electric Conductors. A. E. Woodhouse. 6,010. March 13th.

Distribution Boxes or Section Pillars for Electric Installations or Systems. F. Hewer. 7,232. March 26th.

Electric Time Switches. J. M. Tourtel and W. H. Johns. 7,916. April 2nd.

Automatic Switch for Portable Electric Incandescent Lamps. E. Löwenherz. 8,235. April 5th.

Terminal for Use with Electric Conductors. W. M. Hall 9,146. April 18th.

Electric Motor Starting and Regulation Switches for Organ Blowing, Pumping Up Water Reservoirs, and Similar Devices. H. C. E. Jacoby. 9,859. April 27th.

Electric Switches. J. W. Record and H. Bevis. 11,690. May 19th.

Electrically Lighting Up Gas Lamps. Electrical Improvements, Ltd., and A. E. Hacking. 12,024. May 23rd.

Contact Devices with a Swinging Plug for Electrical Circuits. W. Kreinsen. 12,386. May 28th.

Electric Incandescent Lamps. Sir W. Lloyd Wise. (G. O. Squier.) 13,207. June 7th.

Three-Phase Arc Lamps. J. W. Nasmith. (T. L. Carbone.) 15,107. July 3rd.

Electric Radiators. L. Binko and Phœnix Electric Heating Co. 15,500. July 9th.

Methods of Measuring the Exposure of a Selenium Cell, and to the Application to Photometry, Photo-Telegraphy and the like. A. Korn. 16,343. July 19th.

Method and Apparatus for Vaporising and Igniting Combustible Liquids. S. V. Hardcastle. 16,929. July 27th. (Secret document under Section 44, Patents, &c., Act, 1883.)

Electrical Sparking Devices for Explosion Engines. W. B. Hayden. 19,249. August 28th.

Electrical Ignition Arrangement for Internal Combustion Engines and the like. E. Eisemann. 19,482. August 31st.

Electrical Fusible Cut-Outs. C. M. Dorman, R. A. Smith and H. G. Baggs. 22,845. October 16th.

Electric Transformer Furnaces. A. Lindblad and O. Stalhane. 23,379. October 23rd. (Date applied for under International Convention, May 8th, 1906.)

Electric Switches. E. F. Moy, P. H. Bastie and E. F. Moy, Ltd. 23,629. October 24th.

Alternating Electric Current Distribution Systems. Allgemeine Elektricitäts Gesellschaft, 24,683. November 3rd. (Date applied for under International Convention, November 3rd, 1905.)

Comparison or Standardisation of Electrical Measuring Instruments. M. Kallmann. 28,048. December 8th. (Date applied for under International Convention, July 5th, 1906.)

Storage Battery. S. Lake. 29,147. December 21st.

Field Magnets of Dynamo-Electric Machines. J. W. Burleigh. 5,602. March 8th.

High-Tension Electric Switches. British Thomson-Houston Co. (General Electric Co.) 5,893. March 10th.

High-Tension Electric Switches. British Thomson-Houston Co. (General Electric Co.) 5,893a. March 10th. (Date applied for under Rule 5, Patents Rules 1905, March 10th, 1906.)

Electrodes for Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 6,088. March 13th.

Electric Arc Lamps. J. Brockie. 6,510. March 17th.

Self-Regulating Installations for Producing Electrical or Mechanical Power, or both Simultaneously. H. Tudor. 6,602. March 19th.

Ignition Systems of Electrically-Fired Internal Combustion Engines. Electric Ignition Co. and F. H. Hall. 7,836. April 2nd.

Railway and the like Signalling Systems and Apparatus Therefor. British Thomson-Houston Co. (General Electric Co.) 8,936. April 12th.

Electrolytic Apparatus. A. S. R. Wainwright and F. J. Mann, executors of the late G. J. Atkins 9,706. April 25th.

Dynamo-Electric Machines. Elektricitäts Akt.-Ges. vorm. W. Lahmeyer and Co. 10,993. May 10th.

Sparking Plugs for Electrically-Fired Internal Combustion Engines. Electric Ignition Co. and F. H. Hall. 12,885. May 28th.

Telephone Dictating Machine or Apparatus. W. G. Heys. (K. M. Turner.) 13,311. June 9th.

Machines for Making Incandescent Electric Lamps and the like. British Thomson-Houston Co. (General Electric Co.) 14,361. June 22nd.

Electro-Magnetic Switches Operated by Alternating Current. Allgemeine Elektricitäts Ges. 16,359. July 19th. (Date applied for under International Convention, July 19th, 1905.)

Prepayment Electricity Meters. H. Aron. 17,018. July 27th.

Electric Installations Working with Turbo-Dynamos and Accumulators. M. Grob. 18,179. August 13th. (Date applied for under International Convention, September 19th, 1905.)

Cooling of Dynamo-Electric Machines. Allgemeine Elektricitäts Ges. 19,239. August 28th. (Date applied for under International Convention, August 30th, 1905.)

Joints for Cane or like Rods used in Drain Cleaning, Chimney Sweeping, Electric Cable Wire Hauling, and Kindred Purposes. H. Brassington. 19,666. September 4th.

Apparatus for Controlling and Operating Coal Hoists and the like Electrically. W. Dixon. 19,917. September 7th.

Commutator Bars for Dynamo-Electric and like Machines, and the Method of Fastening the Armature Coil Connectors to such Bars. B. Elshoff. 20,450. September 14th. (Date applied for under International Convention, September 14th, 1905.)